Ground Water Report W 26

1971

Hydrogeology of the Carbonate Rocks of the Lancaster 15-Minute Quadrangle, Southeastern Pennsylvania

Harold Meisler
and
Albert E. Becher

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF
ENVIRONMENTAL RESOURCES
BUREAU OF
TOPOGRAPHIC AND GEOLOGIC SURVEY
Arthur A. Socolow, State Geologist

BULLETIN W 26

Hydrogeology of the Carbonate Rocks of the Lancaster 15-Minute Quadrangle, Southeastern Pennsylvania

by Harold Meisler and Albert E. Becher
U. S. Geological Survey

Prepared by the United States Geological Survey, Water Resources Division, in cooperation with the Pennsylvania Geological Survey

PENNSYLVANIA GEOLOGICAL SURVEY
FOURTH SERIES
HARRISBURG

1971

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PURCHASED FROM
BUREAU OF PUBLICATIONS
DEPARTMENT OF PROPERTY AND SUPPLIES
10th AND MARKET STREETS
HARRISBURG, PENNSYLVANIA 17125

PREFACE

The information in this report on subsurface water resources of the limestone rocks in north-central Lancaster County will benefit all water consumers in that rapidly developing area of southeastern Pennsylvania. The large population growth and rapid commercial and industrial expansion occurring in the area must be supported by a comparable increase in water supplies. Subsurface water must provide a large part of these additional supplies.

The water-yielding capacities of the rocks in this area differ widely from place to place; yields of more than 500 gallons per minute are obtained from favorably located wells. The ground water occurs in fractures and other openings. Many of the openings have been enlarged by the solvent action of water on limestone. Analysis of the yielding capacities of about 250 wells indicates that the best yields are obtained from wells in valleys, while the poorest yields are obtained from wells on hills. The water is usually very hard but generally is of good quality, except for improperly located wells that obtain water contaminated by nearby cesspools or barnyard wastes.

The information in this report should assist planners and water authorities in their efforts to efficiently develop the available water resources. Water well drillers will also benefit from the report through guidance in selecting favorable well sites, determining maximum drilling depths, predicting most probable yields, and anticipating water quality.

CONTENTS

ILLUSTRATIONS

FIGURES

PLATES

(In Box)

TABLES

Hydrogeology of the Carbonate Rocks of the Lancaster 15-Minute Quadrangle, Southeastern Pennsylvania

by

Harold Meisler and Albert E. Becher

ABSTRACT

Limestone and dolomite strata of Cambrian and Ordovician age underlie the lowlands of the Conestoga Valley in southeastern Pennsylvania. In the Lancaster quadrangle, where the Conestoga Valley attains its maximum width, the carbonate strata are divided into 14 units defined primarily by their relative proportions of limestone and dolomite. Thirteen of these units form a continuous stratigraphic sequence. These are, from oldest to youngest: the Vintage, Kinzers, Ledger, and Zooks Corner Formations; the Conococheague Group, consisting of the Buffalo Springs, Snitz Creek, Millbach, and Richland Formations; the Beekmantown Group, consisting of the Stonehenge, Epler, and Ontelaunee Formations; and the Annville and Myerstown Formations. The lower part of the sequence, up to and including the Zooks Corner Formation, is composed predominantly of dolomite. The middle part, up to and including the Richland Formation, contains about equal amounts of limestone and dolomite, and the upper part is dominantly limestone. The Conestoga Formation occurs in only the southern part of the quadrangle and lies unconformably on all units older than the Zooks Corner Formation.

Continuous or recurring deformation from Middle Cambrian to Triassic time has produced a complex structural pattern in the carbonate rocks. This pattern has a northernmost zone dominated by nappe structure consisting of recumbent folds, thrust faults, and a gentle south-dipping axial-plane cleavage; a central zone of variable fold-geometry and intricate faulting; and a southernmost zone dominated by upright, near-isoclinal folds and steeply dipping axial-plane cleavage.

The relative sequence of tectonic events is: 1. epeirogenic movements associated with early Paleozoic unconformities; 2. major deformation, producing recumbent folds; 3. thrust faulting late in the period of recumbent folding or shortly thereafter; and 4. major deformation related to basement adjustments—forming steeply dipping isoclinal folds, open folds, and refolded axial planes and cleavage.

Ground water occurs in bedding and cleavage planes, joints, faults, and other fractures and openings enlarged by solution in the carbonate rocks. The density, size, and extent of interconnection of the openings determine the ability of the rocks to transmit and store water.

Of the 247 wells test pumped for 1-hour in the Lancaster quadrangle, 25 percent have specific capacities greater than 5.0 gpm per ft (gallons per minute per ft of drawdown)—the minimum considered to be adequate for public supply and industrial use; 58 percent have specific capacities greater than 0.5 gpm per ft—the minimum considered to be adequate for small public supply use; and 83 percent have specific capacities greater than 0.08 gpm per ft—the minimum considered to be adequate for domestic use.

The capability of each formation to supply water for several defined general-use categories is evaluated as excellent, very good, good, fair, or poor. For public supply and industrial use, the Stonehenge Formation is a very good source of water and the Vintage, Kinzers, Ledger, Epler, and Conestoga Formations are fair sources of water. For small public supplies and some industrial uses, the Stonehenge and Ledger Formations are excellent sources, the Kinzers and Conestoga Formations are very good sources, and the Vintage and Epler Formations are good sources of water. All formations are capable of supplying water for domestic use. The Zooks Corner Formation and the Conococheague Group have the lowest capability for supplying water in all use categories.

The kind of carbonate rock and the amount of noncarbonate clay, silt, and sand present are important controls on the yield capabilities of the carbonate rocks. The median specific capacity for wells in limestone units is 2.6 compared to medians of 0.91 for dolomite units, and 0.33 for interbedded limestone and dolomite. Wells in units having a relatively low noncarbonate clay, silt, and sand content have a median specific capacity of 1.5 compared to 0.22 for wells in units having a relatively high noncarbonate content.

Valleys are the most favorable and ridges the least favorable topographic positions for drilling wells. Median specific capacities of wells in each of three topographic positions are 1.6 for valleys, 0.5 for intermediate positions, and 0.21 for ridges. In general, this relationship also holds true for individual stratigraphic units.

Median specific capacities are 2.9 for wells less than 100 feet deep, 0.51 for wells 100 to 199 feet deep, and 0.08 for wells 200 to 600 feet deep. Therefore, when adequate supplies of water for any need are not obtained at moderate depths (up to 200 feet), deepening the well is less likely to provide the needed supply than drilling a new well.

The average discharge of the Little Conestoga Creek at the Conestoga Country Club for the 1964 calendar year was 43 cfs (cubic feet per second). Approximately 77 percent of the total streamflow was derived from groundwater discharge. The average specific yield of the zone of water-table fluctuation in the Little Conestoga Creek drainage basin upstream from the Conestoga Country Club is 0.04.

The amount of ground water used in 1965 from the carbonate rocks of the Lancaster quadrangle was about 1.2 to 1.3 billion gallons. Public-supply use increased from 350 million gallons in 1961 to 500 million gallons in 1965.

Water from the carbonate rocks is of the calcium-bicarbonate type. Hardness is generally in excess of 200 ppm (parts per million). Nitrate contamination is common, as 21 of 53 wells and springs sampled contained more than 45 ppm nitrate—the maximum concentration recommended for drinking water by the U.S. Department of Health, Education, and Welfare (1962).

Ground water in carbonate rocks of the Lancaster quadrangle generally has a specific conductance of between 400 and 700 micromhos per centimeter. Specific conductances higher than 700 micromhos are believed to be caused by local contamination from sources such as septic tanks and barnyard wastes. Large areas containing ground water having a specific conductance greater than 700 micromhos occur in the vicinities of Lancaster, Millersville, and Mount Joy.

Calcium-magnesium ratios in ground water correlate well with the composition of the carbonate source rocks. Ratios in water from dolomite units are very close to the stoichiometric proportion of calcium to magnesium in the mineral dolomite. Higher ratios occur in water from interbedded limestone and dolomite, and the highest ratios occur in water from limestone units. Calcium-magnesium ratios are helpful in interpreting the geology where bedrock exposures are scarce.

INTRODUCTION

Lancaster County, long known as a rich agricultural region, has a rapidly growing industrial complex, chiefly in the vicinity of the city of Lancaster. Urban expansion and suburban development have kept pace with this growth, and the demand for water to supply both industrial and domestic needs has increased. Some of this demand is being met by ground water.

The crystalline carbonate rocks that underlie nearly half of the county are the greatest potential source of ground water in Lancaster County. An evaluation of the availability, occurrence, movement, and quality of ground water in these rocks is necessary for the efficient development of the resource.

In September 1962, the U.S. Geological Survey in cooperation with the Pennsylvania Geological Survey, began a study of the hydrology of the carbonate rocks of the Lancaster 15-minute quadrangle. Geologic mapping was done as a fundamental part of this study. Experience gained from hydrologic studies in the carbonate rocks of the Lebanon Valley (Meisler, 1963) has shown the need for a detailed geologic map. A progress report (Meisler and Becher, 1966) containing basic hydrologic and chemical data has been published. The present report describes the geology of the carbonate rocks of

the quadrangle and relates the chemical quality of the ground water to stratigraphy, rock composition, and contamination from the activities of man. Also, it relates the occurrence and water-bearing characteristics of the carbonate rocks to stratigraphy, rock composition, and topography.

LOCATION AND GEOGRAPHIC SETTING

The Lancaster 15-minute quadrangle is located in Lancaster County in southeastern Pennsylvania (Figure 1). The 15-minute quadrangle is divided into the Manheim, Lititz, Lancaster, and Columbia East 7½-minute quadrangles.

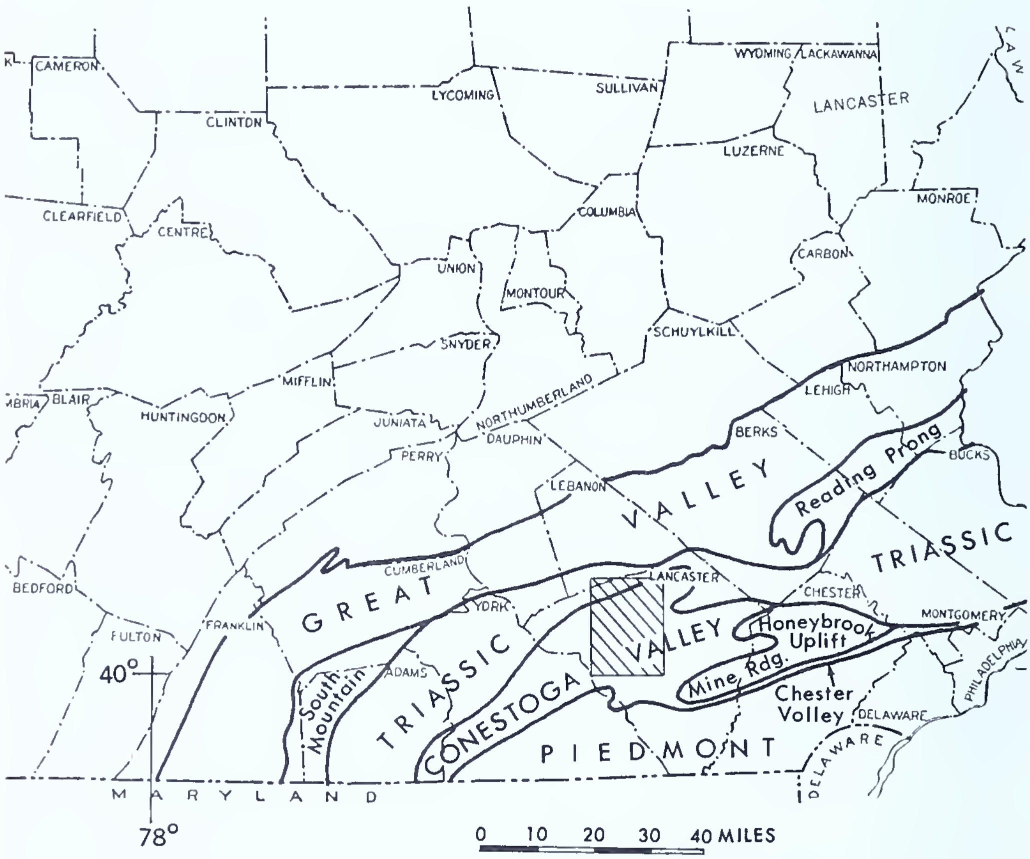


Figure 1. Map of southeastern Pennsylvania showing the physiographic provinces and the location of the Lancaster quadrangle.

Most of the Lancaster 15-minute quadrangle is in the Conestoga Valley of the Piedmont Province. The Conestoga Valley is a lowland underlain chiefly by shale and carbonate rocks. It is bounded on the north by uplands formed on rocks of Triassic age and on the south by uplands formed on crystalline igneous and metamorphic rocks.

In the Lancaster quadrangle, the land surface formed on the carbonate rocks lies approximately 200 to 300 feet below that formed on the shale that

crops out across much of the northern half of the quadrangle and on the siliceous rocks that are interspersed through the carbonate-rock lowland.

Chickies Creek and Conestoga Creek drain almost all of the Lancaster 15-minute quadrangle. They flow southwestward across the quadrangle into the Susquehanna River. Chickies Creek drains most of the western one-third of the quadrangle; Conestoga Creek and its tributary, Little Conestoga Creek, drain the eastern two-thirds of the quadrangle. The extreme southwest corner of the quadrangle is drained by several small streams that flow directly into the Susquehanna River.

METHODS OF INVESTIGATION

Approximately 500 municipal, industrial, and domestic wells and springs were inventoried during this investigation. The well records are given in Table 9, and the spring records in Table 10. Locations of wells and springs are shown on Plate 1. Short-term (1-hour) pumping tests were made at 247 wells in order to determine specific capacities of the wells: these specific capacities are also shown on Plate 1. Continuous water-level records were obtained at four wells. Continuously recording streamflow measuring sites were maintained on Little Conestoga Creek at the Conestoga Country Club and 1 mile southeast of East Petersburg during the period November 1963 through November 1966.

Chemical analyses were made on 70 samples collected from 53 wells and springs and are reported in Table 11. Bicarbonate alkalinity and pH of these samples were determined in the field. Hardness as $CaCO_3$ and specific conductance of water from approximately 450 wells were determined in the field and are reported in Table 9.

Geology of the carbonate rocks was mapped and the results are shown in the geologic map (Plate 1), cross sections (Plate 2), and the structure maps (Figures 5 and 6). Type and reference sections of stratigraphic units are given in the appendix.

PREVIOUS INVESTIGATIONS

The occurrence of ground water in the Lancaster quadrangle is discussed by Hall (1934) as part of a reconnaissance report on ground water in southeastern Pennsylvania. The geology of the Lancaster 15-minute quadrangle is described by Jonas and Stose (1930) in Pennsylvania Geological Survey Atlas 168.

ACKNOWLEDGMENTS

The authors are indebted to the many civic and business organizations, industrial firms, and individual well owners who allowed access to their wells for pumping tests, water-level measurements, and collection of water samples.

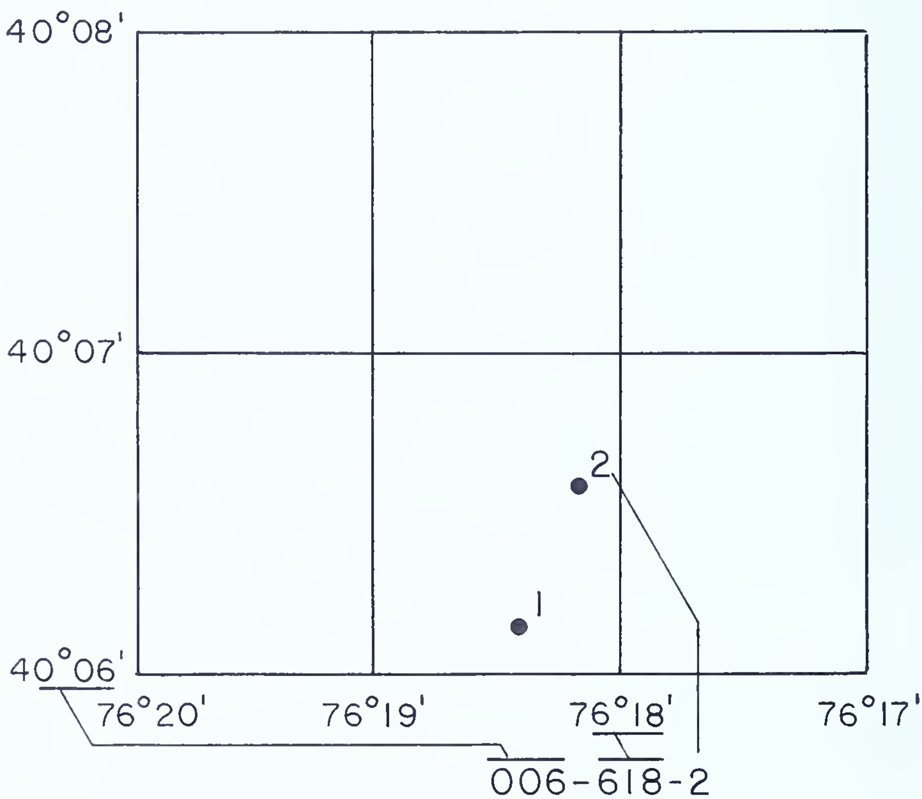
Especially helpful were Lititz Borough Water Department, Millersville Borough Authority, Quaker State Metals Co., and the Conestoga Country Club. The authors are indebted also to the many people who allowed access to their land for geologic mapping.

Professors Donald Wise and Jacob Freedman of Franklin and Marshall College, Lancaster, Pa., were especially helpful in guiding the writers to some understanding of the structural geology of the carbonate rocks of the Piedmont Province.

WELL-NUMBERING SYSTEM

The well-numbering system used in this report shows the location of wells and springs according to the latitude and longitude system illustrated in Figure 2.

The latitude and longitude system consists of a statewide grid of 1-minute parallels of latitude and 1-minute meridians of longitude. Within a 1-minute



Well 006-618-2 was the second well inventoried in the 1-minute area north of the 40°06' parallel of latitude and west of the 76°18' meridian of longitude.

Figure 2. Diagram showing the well-numbering system.

area wells are numbered and springs are lettered consecutively in the order inventoried. For example, in the number 006–618–2, which was assigned to a well near Neffsville in Lancaster County, the first segment (006) is composed of the last digit of the degree (40) and the two digits of the minutes (06) that define the latitude on the south side of a 1-minute quadrangle; the second segment (618) consists of the last digit of the degrees (76) and the two digits of the minutes (18) that define the longitude on the east side of a 1-minute quadrangle; and the last segment (2) indicates the consecutive number assigned to the well as it was inventoried. Similarly, the spring numbered 005–629–A was the first spring inventoried in the 1-minute quadrangle north of the 40°05′ parallel of latitude and west of the 76°29′ meridian of longitude.

CLIMATE

In Lancaster County, summers are long, temperature extremes are moderate, and rainfall is abundant. The average annual precipitation at the U.S. Weather Bureau station at Lancaster for the years 1931 through 1955 was 43.13 inches. The average yearly temperature for the same period was 56.06°F. Approximately 33 percent of the total yearly rainfall takes place in June, July, and August, and 57 percent occurs in the 6-month period from April through September. Summer precipitation, because it is predominantly of the thunderstorm type, is highly variable in quantity and areal distribution. Winter precipitation because it is related to a more general weather pattern, is more uniform in quantity and areal distribution. The following table gives the average monthly rainfall and temperature at Lancaster for the years 1931 through 1955.

Average monthly precipitation (in inches) and temperature (in degrees Fahrenheit) at the U.S. Weather Bureau, Lancaster, 1931-55[1]

Month	Precipitation (inches)	Temperature (°F)
January	3.16	30.4
February	2.61	31.1
March	3.45	40.1
April	3.45	49.8
May	3.54	61.3
June	4.01	70.2
July	4.85	74.5
August	5.28	72.3
September	3.31	65.3
October	3.27	54.0
November	3.21	42.9
December	2.99	32.8
Total	43.13	

[1]Kauffman, N. M., 1960

GEOLOGY

REGIONAL SETTING

Limestone and dolomite of Cambrian and Ordovician age underlie the Chester Valley and most of the Conestoga Valley in southeastern Pennsylvania (Figure 1). The Conestoga Valley is separated everywhere from carbonate rocks of similar age in the Great Valley by a long downfaulted basin containing rocks of Triassic age. In addition, at the western end of the Conestoga Valley, igneous and metamorphic rocks of Precambrian and early Paleozoic age (in South Mountain) separate the Triassic rocks and the Great Valley. Southwestward from Lancaster County the Conestoga Valley narrows as the Triassic rocks gradually overlap the carbonate rocks and the valley ends near the Pennsylvania-Maryland border. Eastward from north-central Lancaster County some narrowing of the Conestoga Valley occurs as the Triassic rocks overlap the carbonate rocks. The valley terminates eastward at the Honeybrook Uplift and Mine Ridge anticline—structural highs that contain a complex of igneous and metamorphic rocks of Precambrian and early Paleozoic age. South of the Honeybrook Uplift and Mine Ridge anticline, the carbonate rocks extend eastward in a very narrow valley—the Chester Valley—to a point north of Philadelphia.

The southern limit of the Conestoga and Chester Valleys is marked by the "Martic Line" (Martic overthrust of Knopf and Jonas, 1929) which separates the carbonate rocks from the lower Paleozoic(?) metamorphic rocks of the Glen Arm Series.

LOCAL SETTING

The Lancaster 15-minute quadrangle is located in the central part of the Conestoga Valley where the carbonate rocks attain their maximum width of 20 to 25 miles. Here, the Triassic rocks, which separate the Conestoga Valley from the Great Valley, narrow to their minimum width of 6 to 10 miles (Figure 1). Triassic rocks form a border across the northern end of the Lancaster quadrangle and are separated from the carbonate rocks to the south by the Cocalico Formation (shale) of Ordovician age (Figure 3).

Siliceous rocks of Early Cambrian age stratigraphically underlie the carbonate rocks in the Lancaster quadrangle. Jonas and Stose (1930) divided the siliceous rocks into the Chickies Quartzite, Harpers Phyllite, and Antietam Quartzite. The Cocalico Formation, a shale unit of Ordovician age (Stose and Jonas, 1922; Jonas and Stose, 1930), overlies the carbonate rocks in the Lancaster quadrangle. These formations were not studied by the writers and they are mentioned in this report only in relation to the carbonate rocks.

The area underlain by carbonate rocks in the Lancaster quadrangle is divided into three east-west trending belts (Figure 3). The Lititz belt is

separated from the Mount Joy belt by a narrow ridge of shale of the Cocalico Formation. The Mount Joy belt is separated from the Lancaster belt by faulted, discontinuous, anticlinal ridges of Lower Cambrian quartzites and phillites. Stratigraphic differences between these belts are discussed in subsequent sections of this report.

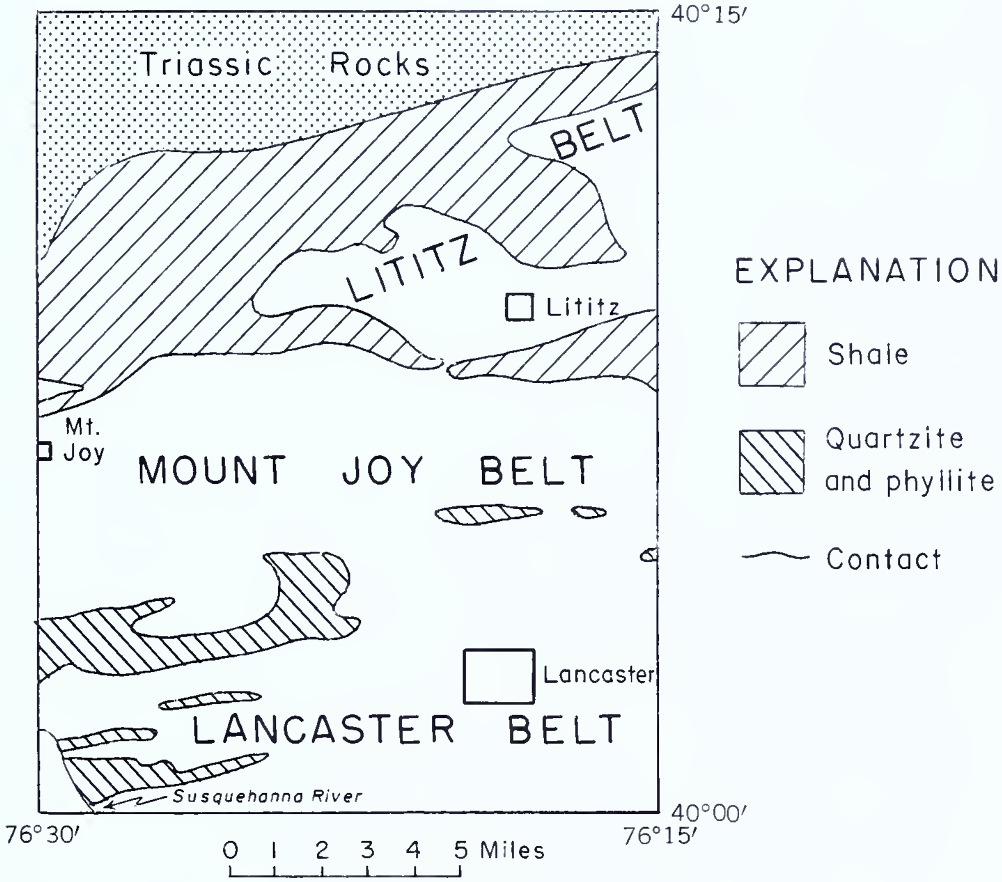


Figure 3. Sketch map showing the three stratigraphic belts in the Lancaster quadrangle.

STRATIGRAPHY

Carbonate rocks of Cambrian and Ordovician age in the Lancaster quadrangle form a stratigraphic sequence, more than 10,000 feet thick, of interfingering, gradationally changing, and commonly recurring lithologies. Detailed mapping (Plates 1 and 2) has shown that this sequence can be divided into rock-stratigraphic units defined primarily by relative proportions of limestone and dolomite. When the proportions of limestone and dolomite are determined for each of a large number of outcrops in an area, units containing similar proportions can be separated and traced along strike. Sub-

Table 1. *Generalized section of the carbonate rocks of Cambrian and Ordovician age in the Lancaster quadrangle, Pennsylvania*

System	Group	Formation	Thickness (in feet)	Character
Ordovician		Myerstown Formation[1]	200±	Limestone, dark-gray, coarsely crystalline, thinly bedded; abundant pelmatozoan stem plates.
		Annville Formation[1]	200±	Limestone, gray, finely crystalline, partly laminated.
	Beekmantown Group	Ontelaunee Formation	0–600±	Dolomite, gray, very finely to finely crystalline; finely laminated in part.
		Epler Formation	2,000–2,500	Limestone and dolomite, interbedded, gray; abundant white beds in lower part; calcarenite beds; pelmatozoan stem plates; coiled gastropods.
		Stonehenge Formation	500–1,000	Limestone, gray; shaly laminae, calcarenite beds, pelmatozoan stem plates.
Cambrian	Conococheague Group	Richland Formation	0–500±	Limestone and dolomite, interbedded, gray; beds of fine conglomerate and calcarenite, rare cryptozoon.
		Millbach formation	1,200–2,000	Limestone, white to pinkish-gray and gray; scattered beds and laminae of gray dolomite.
		Snitz Creek Formation	300–400	Dolomite, gray, argillaceous, silty and sandy.
		Buffalo Springs Formation	1,500–3,800(?)	Limestone and dolomite, interbedded, white to pinkish-gray and gray. Dolomite is commonly argillaceous, silty, and sandy; scattered sandstone beds; cross laminae; ripple marks; and rare cryptozoon.

Cambrian		Zooks Corner Formation	1,600±	Dolomite, gray, commonly silty and sandy; little gray limestone, cross laminae, ripple marks.
		Ledger Formation[1]	1,000±	Dolomite, light-gray, mostly coarsely crystalline, sparkling, partly mottled.
		Kinzers Formation	300–600	Shale gray, rusty weathering; white to gray limestone commonly containing reticulated argillaceous and silty laminae; some dark-gray earthy dolomite.
		Vintage Formation[1]	350–550	Dolomite, gray, very finely to coarsely crystalline; locally contains interbedded limestone.
		In southern part of quadrangle		
Ordovician		Conestoga Formation[1]	Unknown	Limestone, gray, finely to coarsely crystalline; schistose in part; limestone conglomerate near base.

[1] The substitution of "Formation" for the original lithologic designation follows usage of the Pennsylvania Geological Survey (Gray, Shepps, and others, 1960).

Table 2. *Stratigraphic section of the carbonate rocks of the Lancaster quadrangle used by Jonas and Stose (1930) and in this report*

	Jonas and Stose		This report		
Ordovician	Conestoga Limestone (age uncertain)	Cocalico Shale		Cocalico Formation	
				Myerstown Formation	
		Cocalico basal limestone			
				Annville Formation	?
	Beekmantown Limestone		Beekmantown Group	Ontelaunee Formation	Conestoga Formation (age uncertain)
				Epler Formation ?	
				Stonehenge Formation	?
Cambrian	Conococheague Limestone		Conococheague Group	Richland Formation	
				Millbach Formation	
				Snitz Creek Formation	
				Buffalo Springs Formation	
		Elbrook Limestone		Zooks Corner Formation	
	Ledger Dolomite			Ledger Formation	
	Kinzers Formation			Kinzers Formation	
	Vintage Dolomite			Vintage Formation	

ordinate lithologic features, such as color, crystallinity, and fossil detritus aided in the separation of some units. The formations that resulted from this subdivision, and their character and thickness, are shown in Table 1.

Thicknesses were calculated from the geologic map using the width of the zone of outcrop across each formation and an average dip for bedding. These measurements were made at places where structural effects appeared to be minimal. Determinations of thickness may be grossly inaccurate, because the extent of distortion by intensive folding cannot be evaluated and strata may be repeated or omitted by folds or faults that were not detected during mapping. Thicknesses calculated for some formations differed greatly from place to place; so, for those formations, ranges of thickness are shown in Table 1.

A comparison between the stratigraphic nomenclature used by Jonas and Stose (1930), in the Lancaster quadrangle, and in this report is shown in Table 2. The Vintage, Kinzers, Ledger, and Conestoga Formations are retained as defined by Jonas and Stose (1930). The remaining units of Jonas and Stose (1930) are subdivided, redefined, and correlated with units of the

great Valley in Lebanon, Berks, and Dauphin Counties, Pa. (Geyer and others, 1958, 1963; Hobson, 1957, 1963; and Prouty, 1959).

The carbonate sequence is stratigraphically continuous except for the Conestoga, which lies unconformably on all formations older than the Zooks Corner Formation. The lower part of the carbonate sequence, up to and including the Zooks Corner Formation, is composed predominantly of dolomite. In general, the middle part, from the Buffalo Springs Formation to the Richland Formation inclusive, contains approximately equal amounts of limestone and dolomite, and the upper part, from the Stonehenge Formation to the Myerstown Formation inclusive, is composed dominantly of limestone.

Table 3 compares the stratigraphic sections exposed in the three carbonate belts previously defined. The apparent trend toward higher parts of the section being exposed progressively northward is the result of several factors. In the Lancaster belt the units above the Buffalo Springs Formation are missing either because of non-deposition in this area or because of pre-Conestoga and–or recent erosion. The units above the Epler Formation are missing in the Mount Joy belt because of an unconformity at the base of the Cocalico (shale) Formation. In the Lititz belt units below the Buffalo Springs Formation are covered by a thrust plate.

Table 3. *Stratigraphic units present in the Lititz, Mount Joy, and Lancaster belts of carbonate rocks*

Lititz belt	Mount Joy belt	Lancaster belt
Myerstown Formation		
Annville Formation		?
Ontelaunee Formation		
Epler Formation	Epler Formation	? Conestoga
Stonehenge Formation	Stonehenge Formation	Formation
Richland Formation	?	
Millbach Formation	Millbach Formation	?
Snitz Creek Formation	Snitz Creek Formation	
Buffalo Springs Formation	Buffalo Springs Formation	Buffalo Springs Formation
	Zooks Corner Formation	Zooks Corner Formation
	Ledger Formation	Ledger Formation
	Kinzers Formation	Kinzers Formation
	Vintage Formation	Vintage Formation

CAMBRIAN SYSTEM

Vintage Formation

Stose and Jonas (1922) and Jonas and Stose (1926 and 1930) defined the Vintage Formation as the gray dolomite unit that overlies the Antietam Quartzite. The type section is located west of Vintage, Pa., in a cut of the Pennsylvania Railroad. According to Jonas and Stose (1930, p. 24), the lower contact of the Vintage is gradational from . . . "calcareous quartzite at the top of the Antietam" . . . "through a white sericitic siliceous dolomite into gray dolomite". . . . However, the contact in the reference section described in the Appendix (section 1) is sharp, between light-gray granular quartzite and darker gray dolomite.

Most of the Vintage Formation consists of thick-bedded to massive medium-light-gray to medium-dark-gray, very finely to finely crystalline dolomite that contains fine wavy siliceous laminae at some horizons. Some beds are argillaceous or contain thin shale interbeds and commonly appear knotty or lumpy on weathered surfaces. Locally the dolomite sparkles on fresh surfaces, may be mottled, and is medium or coarsely crystalline. In a few localities, white, pinkish-gray, and medium-gray limestones and dolomites are interbedded with more typical Vintage dolomite beds.

The Vintage Formation crops out on the flanks of the anticlinal quartzite ridges that separate the Mount Joy and Lancaster belts, and at the west end of the Lancaster belt. The Vintage Formation is usually absent where faults border the quartzite ridges.

Exposures of the Vintage Formation in the quadrangle are most abundant at the western end of the Lancaster belt. In other areas, exposures are rare, and the formation is usually inferred in covered intervals between the Antietam Quartzite and the overlying Kinzers Formation. The thickness of the Vintage Formation in the Lancaster quadrangle is estimated to be between 350 and 550 feet.

Fossils of Lower Cambrian age have been found in the Vintage Formation in the adjacent Middletown quadrangle (Walcott, 1896, p. 19; Jonas and Stose, 1930, p. 26) but have not been found in the Lancaster quadrangle. These fossils occur in limestone, which appears to be a common lithology in the Vintage west of the Susquehanna River.

Kinzers Formation

The Kinzers Formation of Stose and Jonas (1922), and Jonas and Stose (1926 and 1930) is the unit consisting of shale, limestone, and dolomite that overlies the Vintage Formation. It was named for Kinzers, Pa., where approximately 150 feet of the formation, including the lower contact, is exposed in a cut of the Pennsylvania Railroad. According to Jonas and Stose (1930, p. 26) the lower contact of the Kinzers is marked by ". . . thin beds of impure dolomite which grade into the underlying Vintage dolomite and

weather to a fossiliferous yellow earthy rock or tripoli". In the Lancaster quadrangle the contact was observed in a quarry at Donnerville, where massive light-gray dolomite of the Vintage is overlain directly by abundant shale float of the Kinzers. Here, the earthy yellow tripoli has apparently been covered by shale talus, but it was observed by Jonas and Stose (1930, p. 29).

Although the lithology of the Kinzers Formation is quite varied most of the rock types are distinctive. The shale is medium-gray to medium-dark-gray and has rusty weathering streaks along partings. Bedding can be seen in the shale in those few places where it has not be obliterated by cleavage.

Limestones in the Kinzers Formation are of several types. One common type is thick-bedded to massive, very light-gray to pinkish-gray to medium-dark-gray, very finely crystalline limestone. It contains prominent, anastomosing, argillaceous to silty, laminae and lobate masses, which give the rock a reticulated appearance. Differential weathering of this limestone produces a distinctive irregular honeycomb effect. Another type of limestone is thick-bedded, silty or sandy, medium-gray to medium-dark-gray, finely crystalline, and weathers to a rusty siltstone or sandstone. A third type is thin-bedded, slabby, medium-dark-gray to dark-gray, very finely crystalline and medium to coarsely crystalline limestone, containing black shale partings and disseminated pyrite. A fourth type is thick-bedded, medium-gray, very finely crystalline limestone, containing distorted blebs and masses of medium-gray dolomite that weather white.

Dolomite in the Kinzers is commonly thick-bedded, medium-gray to olive-black, and very finely crystalline. It may contain laminae of limestone or disseminated pyrite. The earthy, fossiliferous dolomite at the base of the Kinzers was observed only in weathered float.

The stratigraphic sequence of lithologies in the Kinzers Formation is not clearly known. In the Hanover-York district, Stose and Stose (1944, p. 18–33) discerned three relatively distinct members in the formation. These are a lower shale member, middle limestone member, and upper silty or sandy limestone member. The lower and upper members have topographic expression as low ridges or hills.

In the Lancaster quadrangle, a line of hills has formed where shale of the Kinzers Formation crops out. These hills, and the abundant shale float on them, make the Kinzers an easily traced unit. In many parts of the Lancaster quadrangle no evidence exists for units other than this shale. In some areas, sandstone float occurs on the hills, intermingled with, or on the up-section side of the shale. In a few places sandstone float occurs also on the down-section side of the shale.

In one area, at the east end of Chestnut Hill, between Roherstown and Florys Mill, evidence exists for at least two units in the Kinzers Formation. Here, the Kinzers crops out through a broad area in a complex of folds that plunge gently to the east and northeast. The shale appears to be the basal unit and is overlain by limestones and dolomites that commonly contain

argillaceous, silty, or sandy laminae and beds. Limestone that weathers into siltstone or sandstone crops out on low hills near the top of the formation and may be equivalent to the upper member of Stose and Stose (1944). Therefore, the threefold division of the Kinzers defined by Stose and Stose (1944) may exist in at least part of the Lancaster quadrangle, but it is not mappable. Where evidence for silty or sandy carbonates exist in the Kinzers, they are separated from the shale on the geologic map (Pl. 1).

The Kinzers Formation crops out on the flanks of anticlinal quartzite ridges in a pattern which generally parallels that of the underlying Vintage Formation. In a few places in the western half of the Mount Joy belt, the Kinzers Formation is repeated by folding and faulting. The formation is estimated to be between 300 and 600 feet thick.

Lower Cambrian fossils such as *Olenellus thompsoni* are abundant in the Kinzers Formation of the Lancaster quadrangle. The reader is referred to Jonas and Stose (1930), and Stose and Stose (1944) for a complete list and discussion of fossils from this formation.

Ledger Formation

The Ledger Formation is the light-gray dolomite unit that overlies the Kinzers Formation. It was named by Stose and Jonas (1922) and Jonas and Stose (1926 and 1930) for the Village of Ledger, Pa., where prominent outcrops occur. In the Lancaster quadrangle, the lower contact of the Ledger is exposed in a newly constructed roadcut of U.S. Route 30, in the north flank of a small anticlinal hill just west of Longs Park. Here, massive, light-gray dolomite of the Ledger Formation overlies well-bedded medium-dark-gray or olive-black dolomite of the Kinzers Formation. These dark dolomite beds grade downward into thin-bedded, dark-gray limestones that weather into a porous siltstone.

The Ledger Formation consists predominantly of massive, very light-gray to light-gray, medium to coarsely crystalline, sparkling dolomite. Commonly the fresh rock exhibits dark mottling. Massive rocks at the northwest end of Reference Section 2 (Appendix) are typical of the Ledger Formation. Beds near the lower and upper contacts of the formation are generally light-gray to medium-light-gray and very finely to finely crystalline. The rocks described in Section 2 (Appendix) occur near the base of the Ledger Formation and are of this type. There are no limestone beds exposed in the formation. However, a few laminae of limestone were observed in a railroad cut just west of the Armstrong Cork Company plant in Lancaster.

The Ledger Formation occurs along the south side of the Mount Joy belt and the north side of the Lancaster belt. The largest single area of occurrence and the best exposures are in the Lancaster belt, north of the city of Lancaster. The formation is estimated to be 1,000 feet thick.

No fossils have been found in the Ledger Formation. Beds formerly thought to be Ledger in the Hanover-York district (Jonas and Stose, 1930,

p. 31), and which contain Lower Cambrian fossils, have been placed in the Kinzers Formation (Stose and Stose, 1944, p. 33). The Ledger is probably of Early Cambrian age—based on its stratigraphic position above a unit of undoubted Early Cambrian age.

Zooks Corner Formation

The Zooks Corner Formation, another dolomite unit, overlies the Ledger Formation. It is named for exposures in the type section (Appendix, Section 3) along Conestoga Creek, one-half mile west of the Village of Zooks Corner (Meisler and Becher, 1968), where nearly half of the formation and the lower and upper contacts are exposed. At the contact with the underlying Ledger, lithologies of the two formations interfinger. This relationship may be seen at several other locations in the quadrangle: in a small quarry several hundred feet northeast of the Fruitville Pike at Penn Rose Park, along Chickies Creek about 1 mile east of Newtown, and along Conestoga Creek south and east of the Lancaster Country Club.

The predominant lithology of the Zooks Corner Formation is thin- to thick-bedded, medium-gray, very finely crystalline dolomite. However, the dolomite ranges in color from white to medium-dark-gray and in crystallinity from cryptocrystalline to coarsely crystalline. Much of the dolomite is silty or sandy and sparsely interbedded with dolomitic sandstones. Many platy or shaly beds occur throughout the section. The dolomite contains many planar features such as color banding, hard siliceous laminae, and shale laminae. Other sedimentary structures scattered throughout the formation include small scale cross-laminae, ripple marks, mud cracks, graded bedding, and a few chaotic structures that appear to be the result of soft-sediment deformation.

White to medium-gray beds of limestone are present, but they constitute only about 5 percent of the rock exposed in the type section. Limestones do not appear to be more abundant in the Zooks Corner Formation elsewhere in the quadrangle.

In the type section (Appendix, Section 3) significant differences in lithology occur at some stratigraphic horizons. Limestones constitute more than 30 percent of the rock exposed in a 50-foot section, located 650 feet below the top of the formation. These limestones commonly contain dolomite as laminae or thin beds. About 900 feet below the top of the formation, and continuing downward for another 100 to 150 feet the dolomite appears to be more argillaceous and silty than the remainder of the section. The lower 100 feet of the type section contains most of the white, very light-gray, pinkish-gray and pale orange dolomites.

The total measured thickness of the Zooks Corner Formation in the type section is between 1,550 and 1,600 feet. This figure is believed to be reasonably accurate, as the section dips north at a constant angle, and the rocks show little evidence of structural thickening or thinning. The formation

crops out across the southern part of the Mount Joy belt and in the northeast part of the Lancaster belt.

Fossils have not been found in the Zooks Corner Formation. As the formation conformably overlies the Ledger Formation, of probable Early Cambrian age, the Zooks Corner is considered to be of Middle (?) Cambrian age.

The rocks that constitute the Zooks Corner Formation were mapped by Jonas and Stose (1930) as Elbrook Limestone and the lower part of the Conococheague Limestone. The contact as mapped by Jonas and Stose between the Elbrook and Conococheague usually falls within the Zooks Corner Formation. In the western part of the quadrangle, where Jonas and Stose (1930, p. 33) did not recognize Elbrook Limestone, the Zooks Corner Formation coincides with the lower part of their Conococheague Limestone.

The present authors believe that Elbrook is not an appropriate stratigraphic name in the Lancaster quadrangle. In the section referred to as Elbrook by Jonas and Stose (1930, p. 32) and described as the type section of the Zooks Corner Formation in this report, the overwhelmingly dolomitic rocks bear little resemblance to the Elbrook Limestone at its type locality in Franklin County, Pa. Rocks mapped as Elbrook elsewhere in the Lancaster quadrangle by Jonas and Stose (1930), that do resemble the Elbrook in its type locality, have been mapped by the authors as part of the overlying Buffalo Springs Formation.

Conococheague Group

The sequence of limestones and dolomites previously mapped as Conococheague (Jonas and Stose, 1930) can be separated, on the basis of lithology, into four rock-stratigraphic units. These units, the Buffalo Springs, Snitz Creek, Millbach, and Richland Formations, are correlated, on the basis of stratigraphic position and lithologic similarity, with units in the Great Valley, in Lebanon County, Pa. (Table 4.)

Table 4. *Correlation of the Conococheague Group in the Lancaster quadrangle and Lebanon and Berks Counties, Pa.*

<table>
<tr><th colspan="2">Lebanon County
(Gray and others, 1958)</th><th colspan="2">Berks County
(Geyer and others, 1963)</th><th colspan="2">Lancaster quadrangle
(This report)</th></tr>
<tr><td rowspan="5">Conococheague Formation</td><td>Richland Member</td><td rowspan="4">Conococheague</td><td>Richland Formation</td><td rowspan="5">Conococheague Group</td><td>Richland Formation</td></tr>
<tr><td>Millbach Member</td><td>Millbach Formation</td><td>Millbach Formation</td></tr>
<tr><td>Schaefferstown Member</td><td rowspan="2">Snitz Creek Formation</td><td rowspan="2">Snitz Creek Formation</td></tr>
<tr><td>Snitz Creek Member</td></tr>
<tr><td>Buffalo Springs Member</td><td colspan="2">Buffalo Springs Formation</td><td>Buffalo Springs Formation</td></tr>
</table>

The Conococheague Formation in Lebanon County was divided by Gray and others (1958) into five members. Geyer and others (1963) subsequently raised four of these members to formation rank and raised the Conococheague Formation to group rank. Geyer and others (1963) separated the Buffalo Springs Formation from the Conococheague Group by correlating the Buffalo Springs Formation with the Elbrook Formation at its type locality in Franklin County, Pa. and by correlating the overlying Snitz Creek Formation with the basal Big Springs Station member of the Conococheague Limestone in Maryland (Wilson, 1952, p. 307–308).

This report retains the group rank of the Conococheague in the Lancaster quadrangle. The authors include the Buffalo Springs Formation within the Conococheague Group for the following reasons: (1) Most of the Buffalo Springs Formation was mapped as Conococheague Limestone by Jonas and Stose (1930). The lower contact of their Conococheague Limestone either coincides generally with the lower contact of the Buffalo Springs or is within or at the base of the underlying Zooks Corner Formation. (2) The lower contact of the Buffalo Springs Formation is the best defined and most readily traceable contact within the Cambrian carbonate sequence. (3) The Snitz Creek Formation is not separable from the Buffalo Springs Formation everywhere in the Lancaster quadrangle. (4) Lithologies in the Buffalo Springs Formation are similar to lithologies of other formations in the Conococheague. Dolomites in the Buffalo Springs are similar to those of the Snitz Creek Formation and some limestones in the Buffalo Springs are similar to those in the Millbach Formation. (5) The occurrence of prominent beds of sandstone in the Snitz Creek Formation is an important criterion for considering this unit to be basal Conococheague in the Lebanon Valley. However, in the Lancaster quadrangle, beds of sandstone are common also in the underlying Zooks Corner and Buffalo Springs Formations. (6) Correlation of the Snitz Creek Formation with the Big Springs Station Member in Maryland is highly tenuous as the latter unit cannot be traced northeastward from Maryland across Franklin County, Pa. (Root, 1967).

The authors recognize the possibility that other limits could be placed on the Conococheague Group in the Lancaster quadrangle. However, they believe that the original limits established by Jonas and Stose (1930) in the Lancaster quadrangle should be maintained as nearly as possible until more detailed mapping in adjacent areas provides firmer evidence for correlation with the type area of the Conococheague in Franklin County, Pa.

Fossils, which would establish the age of the rocks, have not been found in the Conococheague Group in the Lancaster quadrangle, or in Lebanon County in the Great Valley. In Franklin County, the Conococheague Limestone contains fossils of Upper Cambrian age. Cryptozoon occur in the Conococheague rocks of Lancaster, Franklin, and Lebanon Counties. The Kinzers Formation, which is stratigraphically about 2,600 feet below the base of the Conococheague Group in the Lancaster quad-

rangle, is of Early Cambrian age. Therefore, the evidence suggests a Middle and/or Upper Cambrian age for the Conococheague Group in the Lancaster quadrangle. The age designations of Geyer and others (1963, Figure 10) are here applied to the Lancaster quadrangle, and the Buffalo Springs Formation is considered Middle (?) Cambrian in age. All younger formations in the Conococheague Group are considered Upper Cambrian.

Buffalo Springs Formation

The Buffalo Springs Formation is the interbedded limestone and dolomite sequence that overlies the Zooks Corner Formation. The lower contact is gradational but is defined as the base of the lowest thick limestone of an interbedded limestone and dolomite sequence. Good exposures of the contact and the lower part of the formation can be seen along Conestoga Creek, west of Holland Heights (Appendix, Section 3), and in a roadcut on Route 222, one-half mile south of Oregon.

The Buffalo Springs Formation consists of white to very light pinkish-gray, and medium-gray to medium-dark-gray limestones, interbedded with very light pinkish-gray and yellowish-gray to medium-dark-gray dolomite. The limestones commonly contain thin oolitic zones and dolomitic laminae, patches, and stringers. The dolomites are commonly argillaceous, silty, or sandy and contain mudcracks, flow casts, ripple marks, and cross laminae. Thin dolomite pebble conglomerate lenses and chert stringers occur in beds of both limestone and dolomite. Cryptozoon are rare but occur in both limestone and dolomite.

The Buffalo Springs Formation displays substantial lateral variations in color and composition. White and light-gray rocks predominate in many areas; darker gray rocks predominate in other areas. Thick silty and sandy lenses of dolomite (up to 700 feet thick), which are similar lithologically to the Snitz Creek Formation, occur within the Buffalo Springs Formation in the western part of the Mount Joy belt. One of these lenses, exposed in a railroad cut at Salunga, is described in the Appendix, Section 4.

The Buffalo Springs Formation extends across the entire Lititz belt, but the lower part of the formation is covered by a thrust plate. The Buffalo Springs also occurs across the entire Mount Joy belt but the upper beds may be faulted out in the eastern two-thirds of the belt. In the northeastern part of the Lancaster belt, the lower part of the Buffalo Springs is exposed in the center of a broad open syncline (Eden syncline). The thickness of the Buffalo Springs Formation is estimated to be between 1,500 and 3,800 feet.

Snitz Creek Formation

The Snitz Creek Formation is the dolomite sequence that overlies the Buffalo Springs Formation. The lower contact is gradational but is defined as the top of the highest thick bed of limestone below a dolomite sequence. This contact and much of the Snitz Creek section is exposed about 1 mile south

of Mount Joy, in a roadcut just east of Little Chickies Creek. The upper contact with the overlying Millbach Formation is also exposed here.

Typically, the Snitz Creek Formation contains light-gray to dark-gray, very finely to finely crystalline dolomite. Much of the dolomite is argillaceous, silty, or sandy and may appear shaly or platy in outcrop. A few scattered beds of dolomitic quartz sandstone and white or medium-gray limestone occur in the unit.

The Snitz Creek Formation is traceable along strike for approximately 2 miles at the west end of the Mount Joy belt and for an equal distance at the east end of the Lititz belt (Plate 1). In parts of the Mount Joy and Lititz belts, where a predominant dolomite sequence does not occur between the Buffalo Springs and Millbach Formations, the rocks below the Millbach are mapped as Snitz Creek-Buffalo Springs, undivided. However, through the eastern one half of the Mount Joy belt the Snitz Creek Formation, if present, must be concealed beneath a thrust fault. The Snitz Creek Formation is estimated to be 300 to 400 feet thick.

Millbach Formation

The Millbach Formation is the predominantly limestone sequence that overlies the Snitz Creek Formation. Where the Snitz Creek cannot be distinguished, the Millbach overlies the undivided Buffalo Springs and Snitz Creek Formations. No extensive sections of the Millbach Formation are exposed in the Lancaster quadrangle. However, the contact with the Snitz Creek Formation is exposed at several places in the quadrangle. The best exposure is about 1 mile south of Mount Joy, in a roadcut just east of Little Chickies Creek. Here, in the overturned limb of a fold, about 100 feet of a continuous dolomite section is stratigraphically overlain by about 50 feet of a continuous limestone section. The contact is gradational and is defined as the top of the stratigraphically highest thick dolomite below a predominantly limestone sequence. Where the Millbach Formation overlies undivided Snitz Creek and Buffalo Springs, the contact is mapped where a significant decrease in dolomite content occurs in the section.

The Millbach Formation consists of white to light-pinkish-gray limestone containing some light-gray to medium-light-gray laminae or thin beds of dolomite, and medium-gray to medium-dark-gray limestones containing scattered interbeds of light-pinkish-gray to medium-gray dolomite. Most of the rocks are very finely to finely crystalline. Silty and sandy beds are present but are less common than in the underlying formations. A few beds of carbonate cemented quartz sandstone are present. Thin beds, lenses, and stringers of chert are scattered through the formation. Most exposures display tight bedding folds and a cleavage that deforms or obliterates bedding and other sedimentary features.

The Millbach Formation is mappable across the Lititz belt and in the

western one-third of the Mount Joy belt. Across the remainder of the Mount Joy belt, if the Millbach Formation is present, it is probably concealed beneath a thrust fault. The thickness of this formation is estimated to be between 1,200 and 2,000 feet.

Richland Formation

The Richland Formation is defined as the interbedded limestone and dolomite unit that overlies the predominantly limestone Millbach Formation. The Richland Formation in the Lancaster quadrangle differs considerably from the type section of this formation in the Great Valley (Gray and others, 1958). In Lebanon County the formation consists predominantly of dolomite, whereas in the Lancaster quadrangle dolomite is subordinate to limestone. It is estimated that the Richland Formation, in the Lancaster quadrangle, contains about 70 percent limestone and 30 percent dolomite. The name Riehland is retained in the Lancaster quadrangle because these rocks occupy the same stratigraphic position as the Richland Formation in Lebanon County, contain similar sedimentary characteristics, and are clearly different than the underlying and overlying formations.

Rocks in the Richland Formation are medium-gray to medium-dark-gray, finely crystalline, interbedded limestone and dolomite. The limestones commonly contain disseminated grains, patches, and laminae of dolomite and some beds of fine conglomerate and calcarenite. Rarely, thin beds or stringers of chert are present. Cryptozoon also are rare but do occur in the formation.

The Richland Formation is exposed only in a small area at the east end of the Lititz belt (Plate 1). It can be traced for several miles to the east and northeast in the adjacent quadrangle. Westward, however, exposures of the Richland end abruptly, and the unit is probably concealed beneath a thrust plate. There is no evidence to indicate the occurrence of the Richland in the Mount Joy belt. It may underlie the same thrust plate that conceals the Millbach Formation through most of this belt. At the western end of the Mount Joy belt the Richland probably does not occur in the stratigraphic section. Where present, the Richland Formation is estimated to be about 550 feet thick.

ORDOVICIAN SYSTEM

Beekmantown Group

Detailed mapping by the authors in the Lancaster quadrangle has shown that strata mapped as Beekmantown Limestone by Jonas and Stose (1930) can be divided into the following three geologic units: the Stonehenge Formation, Epler Formation, and Ontelaunee Formation. These units are correlated, on the basis of stratigraphic position and lithologic similarity, with units of the Beekmantown Group (Hobson, 1957) in Berks County, Pa. A

fourth unit, called the Rickenbach Formation by Hobson (1957) and lying between the Stonehenge and Epler Formations in Berks and Lebanon Counties, is not present in the Lancaster quadrangle.

Studies by Hobson (1963, p. 8 and 9) indicate that the boundary between the Cambrian and Ordovician Systems in Berks County is somewhere between the middle member of the Stonehenge Formation and the uppermost exposed beds of the Conococheague Group. In the Lancaster quadrangle the system boundary is less clearly known, but it is placed at the base of the Stonehenge Formation for the following reasons: (1) the Stonehenge Formation in Franklin County is Ordovician in age, (2) the boundary between the Cambrian and Ordovician Systems in Lebanon County is placed at the base of the Stonehenge Formation (Geyer, 1963, Fig. 10), (3) fossils from the Epler Formation in the Lancaster quadrangle have been ascribed to the *Turritoma* zone of the Beekmantown Limestone in the Cumberland Valley (Jonas and Stose, 1930, p. 38), (4) fossils of similar type occur in both the Stonehenge and Epler Formations in the Lancaster quadrangle, and (5) fossils similar to those in the Beekmantown Group have not been found below the Stonehenge Formation in the Lancaster quadrangle.

Stonehenge Formation

The Stonehenge Formation is defined as the gray-limestone sequence that overlies the Richland Formation. However, the Stonehenge and Richland Formations are in contact only at the eastern end of the Lititz belt. No exposures of the contact were observed in this area. In most areas the Richland is absent and the Stonehenge is in probable fault contact with the Millbach or Buffalo Springs Formations. However, at the western end of the Mount Joy belt, the sequence of Stonehenge overlying Millbach may be a normal stratigraphic relationship.

Although the nature of the contact of the Stonehenge Formation with rocks of the Conococheague Group is not everywhere clear, a sharp contrast in lithologies makes this contact one of the most traceable in the Lancaster quadrangle. The contact is mapped at the base of a monotonous sequence of gray limestone.

The Stonehenge Formation consists of medium-gray to medium-dark-gray, very finely to finely crystalline limestone, which commonly contains dark-shale laminae that weather into prominent ribs in some outcrops. Beds of calcarenite are common locally and contain fossil detritus including abundant pelmatozoan stem plates. Although some calcarenite beds occur in older formations, they do not contain megascopically visible pelmatozoan stem plates. Coiled gastropods and broken pieces of brachiopod or pelecypod shells are seen rarely in the Stonehenge Formation.

The Stonehenge Formation crops out in continuous bands across both the Lititz and Mount Joy belts. It is estimated to be 500 to 1,000 feet thick.

Epler Formation

The Epler Formation is defined as the interbedded limestone and dolomite sequence that overlies the Stonehenge Formation. The contact between these formations is placed at the base of the lowest prominent dolomite of a sequence of interbedded limestone and dolomite. No exposures of this contact were observed in the Lancaster quadrangle.

The Epler Formation has the most varied lithology of any formation in the Beekmantown Group. A reference sequence across most of the formation is described in the Appendix, Sections 5 and 6. This sequence can be subdivided into several rock-stratigraphic units, but these units could not be mapped in the Lancaster quadrangle.

In general, the Epler Formation consists of intervals of interbedded limestone and dolomite separated by intervals of limestone. Many of the dolomites are calcareous, and all gradations between pure dolomite and pure limestone are present. The lower part of the formation contains many beds of white to light-pinkish-gray limestone and dolomite. Such rocks predominate near the base, and light-colored limestones have been very useful in mapping the lower contact of the formation where dolomite beds are scarce or not exposed. The remaining limestones and dolomites in the formation are medium-light-gray to dark-gray. Most of the rocks are very finely and finely crystalline and contain many types of laminae such as shale partings and color bands. Fossil detritus occurs commonly and is abundant in calcarenite beds. Pelmatozoan stem plates are the most common fossils but coiled gastropods are also present. Chert occurs in lenses and stringers scattered through the formation.

The Epler Formation crops out in broad bands across both the Mount Joy and Lititz belts. The thickness of this formation is estimated to be between 2,000 and 2,500 feet.

In the Lititz belt the formation appears to contain much less dolomite than in the Mount Joy belt. This scarcity of dolomite may be the result of the Lititz belt being on the overturned limb of a large recumbent fold. On such limbs, dolomite beds, when interbedded with limestone, tend to thin, form boudins, and brecciate. Weathering tends to destroy the remnants of such dolomite beds more rapidly than the interbedded limestone.

Pre-Cocalico unconformity

The normal stratigraphic sequence above the Epler is the Ontelaunee, Annville, Myerstown, and Cocalico Formations. However, in the Mount Joy belt the Cocalico Formation overlies the Epler and the intervening formations are absent. Across most of the Lititz belt the Ontelaunee Formation occurs discontinuously between the Epler and Cocalico Formations. In the most northeasterly part of the Lititz belt (around Hammer Creek north of Brunnerville), the Ontelaunee overlies the Epler everywhere and the Ann-

ville overlies the Ontelaunee almost everywhere, but the Myerstown Formation is present only in one small area. These relationships suggest that the Cocalico Formation unconformably overlies the truncated edges of progressively older formations in a southerly direction. Southward thinning of the Ontelaunee Formation provides further evidence for an unconformity. Jonas and Stose (1930, p. 42) also report an unconformity at the base of the Cocalico Formation. Studies by many workers (Gray, 1952; Prouty, 1959; Hobson, 1963) in the Great Valley, north of the Lancaster quadrangle, indicate an unconformity at the base of the Martinsburg Formation (stratigraphic equivalent of the Cocalico Formation). In some places in the Lititz belt, faulting or shearing probably is partly responsible for missing units above the Epler Formation.

Ontelaunee Formation

The Ontelaunee Formation is the dolomite sequence that overlies the Epler Formation. The contact between these formations is defined as the top of the highest limestone in the sequence of interbedded limestone and dolomite beneath the dolomite sequence of the Ontelaunee Formation. This definition differs from that in Berks County, where according to Hobson (1963, p. 17) . . . "the contact between the Epler Formation and the overlying Ontelaunee Formation in central Berks County is placed at the top of the highest limestone bed beneath a prominent zone of chert beds in the Ontelaunee." This chert zone is not recognizable and, hence, cannot be used in the Lancaster quadrangle. The lower contact in the Lancaster quadrangle and the entire Ontelaunee section in this area is exposed in a quarry adjacent to the sewage disposal plant on the south side of the Borough of Manheim. A description of the rocks in this quarry can be found in the Appendix, Section 7. Another exposure of this sequence and the contact with the overlying Cocalico Formation can be seen in a quarry one-half mile farther east.

The Ontelaunee Formation consists mostly of medium-light-gray to medium-dark-gray cryptocrystalline to very-finely crystalline dolomite that commonly contains fine laminae. A few dark-gray cryptocrystalline beds of limestone are scattered through the sequence. No fossils have been found in this formation.

The Ontelaunee was calculated to be 600 feet thick at Clay, the northernmost area of exposure in the Lititz belt. The quarry south of Manheim, in the Lititz belt (Appendix, Section 7), contains only 62 feet of Ontelaunee beds from the exposed lower contact to a concealed interval of 5 feet between the Ontelaunee and overlying Cocalico Formation. Further south, in the Mount Joy belt, the Ontelaunee Formation is not present between the Epler and Cocalico Formations. The southward thinning of the Ontelaunee Formation is believed to be caused by an erosional truncation as discussed in the section on the pre-Cocalico unconformity.

Annville Formation

The Annville Formation in the Lancaster quadrangle is defined as the lower part of the limestone sequence that overlies the Ontelaunee Formation. It is correlated on the basis of lithologic similarity and stratigraphic position with the Annville Limestone of the type section in Dauphin County (Prouty, 1959). The contact between limestones of the Annville and dolomites of the Ontelaunee is exposed along the south side of the road one-half mile southwest from Hammer Creek Church.

The formation consists of light-gray to medium-dark-gray, finely crystalline, partly laminated limestone. Commonly, weathered surfaces are conspicuously fluted. A reference section of the Annville is described in the Appendix, Section 8.

The Annville Formation crops out only in the extreme northeastern part of the Lititz belt. The thickness of the formation is estimated to be about 200 feet.

According to Prouty (1959, p. 12), the Annville Formation in Dauphin County is of Chazy (Middle Ordovician) age. A similar age is suggested for the Annville in the Lancaster quadrangle.

Myerstown Formation

The Myerstown Formation, in the Lancaster quadrangle, overlies the Annville Formation. It is the upper part of the limestone sequence above the Ontelaunee Formation and is correlated on the basis of stratigraphic position and lithologic similarity with the Myerstown Limestone of the type section in Dauphin County (Prouty, 1959).

The lower contact with the underlying Annville Formation is not exposed in the Lancaster quadrangle. However, rocks of the Annville Formation are separated from rocks in the reference section of the Myerstown Formation (Appendix, Section 9) by a concealed interval of less than 5 feet.

The Myerstown Formation underlies an extremely small area approximately 3 miles north-northeast of Lititz, in the Lititz belt. The exposure is limited to two outcrops that contain dark-gray, coarsely crystalline, thinly bedded limestone, and dark-gray shaly limestone. Fossil detritus, including pelmatozoan stem plates, is abundant. The thickness of the Myerstown Formation is about 200 feet.

In Dauphin County the Myerstown Limestone is overlain by the Hershey Formation. There is no evidence to indicate the presence of the Hershey Formation in Lancaster County. Here, the Cocalico Formation overlies the Myerstown Formation, but no exposures of the contact have been observed.

According to Prouty (1959, p. 17–19) the Myerstown is of Middle Ordovician age in the Great Valley. A similar age is suggested for the Myerstown in the Lancaster quadrangle.

Conestoga Formation

The Conestoga Formation is a limestone sequence named by Stose and Jonas (1922, p. 359, 365–366) for exposures along Conestoga Creek south of Lancaster. In the Lancaster quadrangle, the Conestoga unconformably overlaps the Ledger, Kinzers, and Vintage Formations.

In general, the Conestoga Formation consists of medium-gray and medium-dark-gray, finely to coarsely crystalline limestone. Commonly, the limestones contain argillaceous laminae. Much of the formation has a schistose appearance and contains thin graphitic or micaceous beds or laminae. The base of the formation is usually marked by beds of conglomerate containing carbonate clasts of both similar and different lithology than the matrix. These clasts range in size from pebbles to boulders 5 feet across. Coarsely crystalline, silty, and sandy limestones also occur near the base of the formation and in some places are interbedded with conglomerates. Beds of dolomite identical in appearance to adjacent beds of limestone are well exposed in front of the Radio Corporation of America plant at the northeast end of Lancaster. Dolomite has not been observed elsewhere in the Conestoga Formation.

There are many excellent exposures of the Conestoga Formation south and east of Lancaster along Conestoga and Mill Creeks and in quarries, road, and railroad cuts. Most of the lithologies present in the formation can be seen here or in exposures and quarries east of Columbia.

The Conestoga Formation occurs only in the Lancaster belt. The zone of outcrop is 3 to 4 miles wide across the southern part of the quadrangle, but an additional 3 to 5 miles of width is exposed south of the border of the Lancaster quadrangle.

The thickness of the Conestoga Formation is not known. Multiple folding combined with the broad zone of exposure makes it impossible to estimate the thickness. However, the formation must be at least 1,000 feet thick.

The age of the Conestoga Formation has long been a controversial subject and still is unresolved. Fossils have not been found in the Lancaster quadrangle nor have the stratigraphic correlatives of the Conestoga been established. At present, the Conestoga is believed to be of Early Ordovician age, but it may be partly of Cambrian age. The problem is discussed fully by Jonas and Stose (1930, p. 44–47) and Stose and Stose (1944, p. 37–38).

STRUCTURE

The cumulative effects of continuous or recurring deformation have produced a complex structural pattern in the carbonate rocks of the Lancaster quadrangle. Features of this pattern include variable styles of folding, two areally separated sets of axial-plane cleavage, warped and folded axial planes

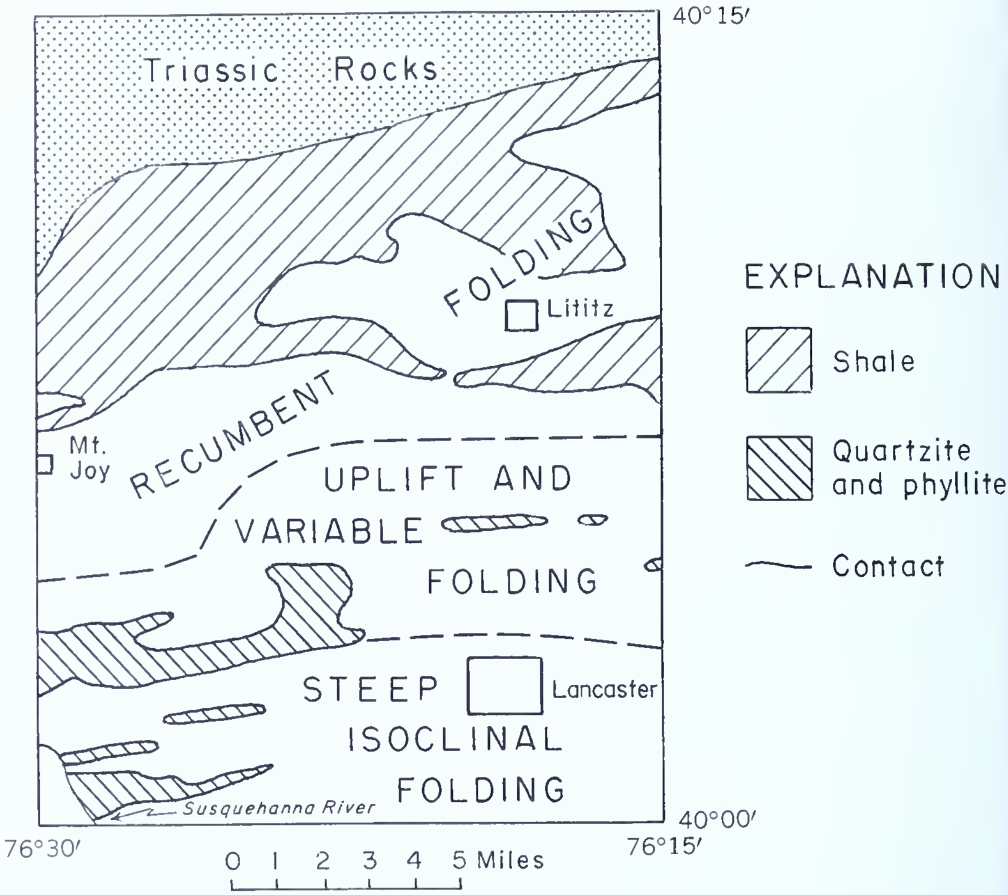


Figure 4. Sketch map showing three structural zones in the Lancaster Quadrangle.

and axial-plane cleavages, areas of chaotic cleavage and bedding, distorted and disrupted folds, and thrust faults.

The complex structure of the carbonate rocks can best be discussed by considering three structurally contrasting zones as shown in Figure 4. A distinct or dominant structural character defines each zone. As there are no sharp changes between zones, the boundaries are commonly drawn through areas that contain structural features common to both the bounded zones.

The northernmost zone, called the zone of recumbent folding, includes the Lititz belt and the northern part of the Mount Joy belt. In this zone, the dominant pattern is one of nappe structure consisting of isoclinal folds that are recumbent or strongly overturned to the north and imbricate thrusting. The general trend of this zone in the carbonate rocks is northeast-southwest and the magnitude of the folds decreases to the south. Folds in this zone, whether large or small, exhibit a well developed axial-plane cleavage that generally dips gently to moderately southward. Where folds are overturned past recumbency, or are warped by later folding, the cleavage dips to the north or east. A generalization of cleavage measurements in the Lancaster

quadrangle is shown in Figure 5. Areas where overturned limbs of folds are exposed at the land surface in the zone of recumbent folding are also shown in Figure 5.

Imbricate thrust faulting is an important feature of the zone of recumbent folding. Displacement on thrust faults appears generally to increase to the west. As interpreted by the writers, the thrusting occurred at a late stage of

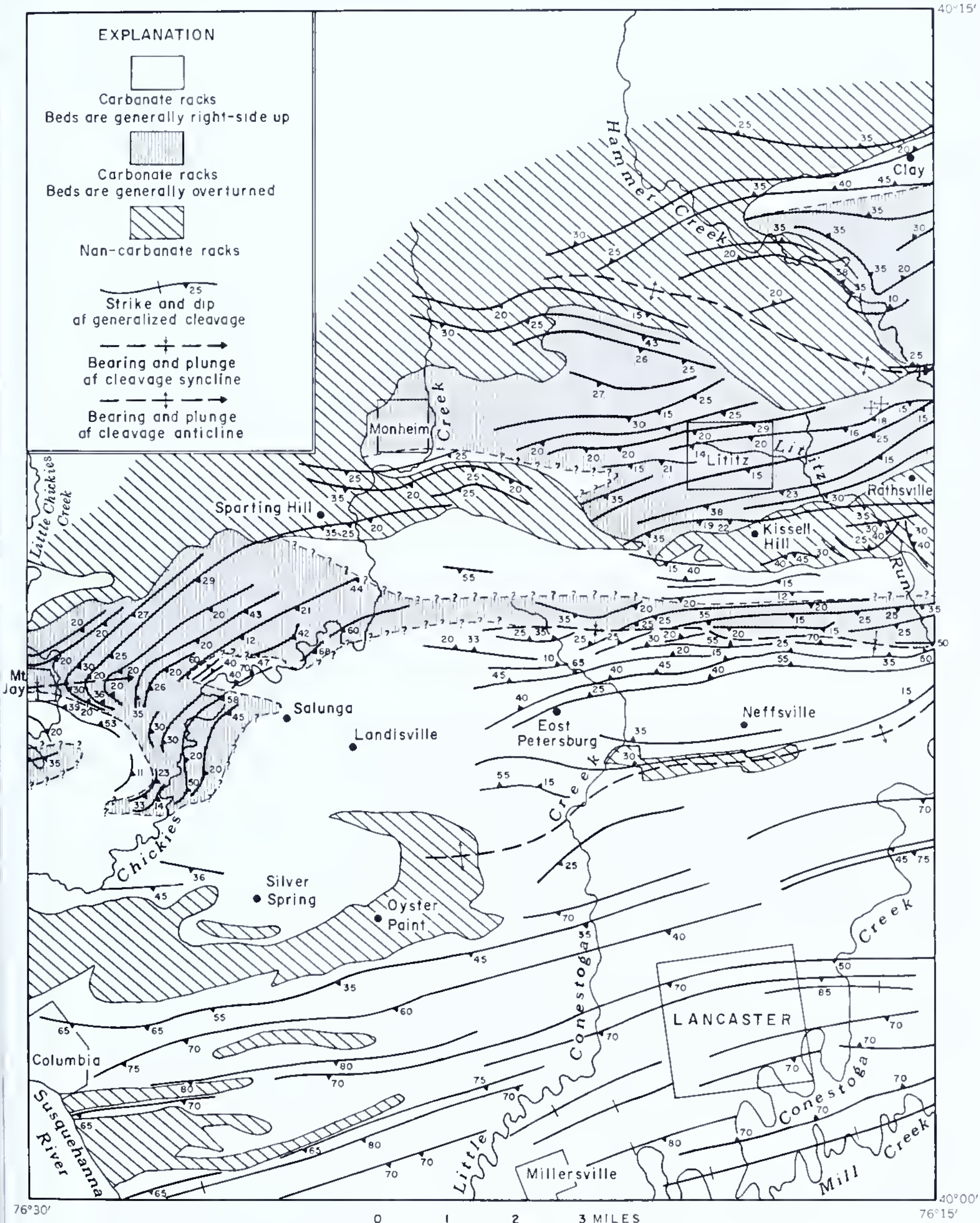


Figure 5. Map showing generalized cleavage and areas of overturned beds in the Lancaster 15-minute quadrangle, Lancaster County, southeastern Pennsylvania.

recumbent folding or after the folds were formed. However, some thrusting may have occurred earlier—perhaps even before recumbent folding.

The southernmost zone, called the zone of steep isoclinal folding, includes the Lancaster belt south of the northernmost exposures of the Conestoga Formation. In this zone the dominant structural pattern is one of upright or slightly overturned isoclinal folds and steeply dipping axial-plane cleavage. (Figure 5). Folds with amplitudes up to half a mile are present at the west end of this zone where the exposure of several formations clearly outlines the dominant fold pattern (Plate 1). Vertical and reverse faults occur in the western part of the zone (Plate 1) and probably in other parts also.

The central zone, called the zone of uplift and variable folding, includes the southern part of the Mount Joy belt, and the Lancaster belt north of the outcrop area of the Conestoga Formation. The most prominent structure present is the complex anticlinal uplift whose crest occurs generally in the quartzite ridges. Folds in this zone are generally open and upright although some tighter folds, slightly overturned to the north, are present. This fold geometry differs considerably from that of folds in both the adjacent areas.

Cleavage is scarce in the zone of uplift and variable folding and could not be used to determine the genetic relationship of folds in this zone to the recumbent folds further north and to the steep isoclineal folds further south. Faulting, including thrust faulting, has added to the structural complexity of this zone. The nature of some of the faults is unknown.

The following sections of this report discuss, in greater detail, the zones described briefly above.

ZONE OF RECUMBENT FOLDING

The largest structural features in the zone of recumbent folding are the Hammer Creek and Manheim Anticlines. (Plate 2 and Figure 6). These are individually named anticlines because their areal separation makes it possible to interpret them as two distinct folds. However, they are interpreted by the authors as a single fold that has been complicated by refolding and faulting.

The Hammer Creek Anticline is a large eastward plunging fold that is overturned to the north beyond recumbency. The axial surface dips north and its trace strikes east. If only one fold is present, then the axial surface of the Hammer Creek Anticline bends over the Brunnerville Arch (Plate 2 and Figure 6) and dips south into the Manheim Anticline. The Brunnerville Arch strikes and plunges to the southeast but probably consists of a series of open folds that strike more easterly than the trend of the arch.

The Manheim Anticline is a strongly overturned fold of large dimensions. The axial surface dips south and its trace strikes east. At the west end of the fold, in the carbonate rocks, the fold axis plunges to the west. The upper limb of the anticline is exposed south of Manheim and probably forms the

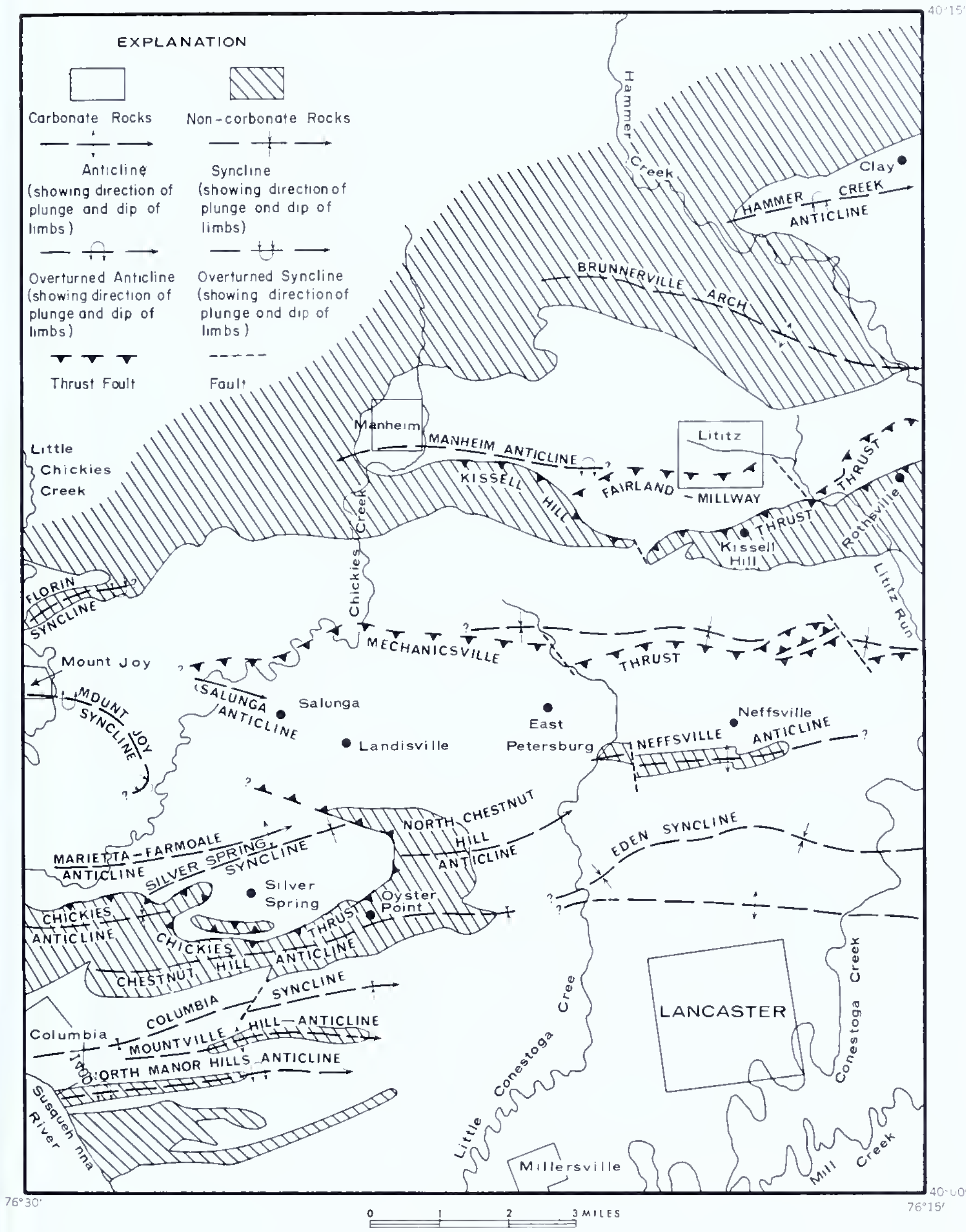


Figure 6. Map showing the location of major structural features in the Lancaster 15-minute quadrangle, Lancaster County, southeastern Pennsylvania.

lower limb of a smaller recumbent syncline whose upper limb is exposed southwest of Sporting Hill.

Several thrust faults disrupt the Manheim Anticline along the south side of the Lititz belt east of the town of Manheim. The Kissell Hill Thrust (Plate 1 and Figure 6), which brings the Cocalico Formation in contact with rocks

ranging from the Buffalo Springs Formation to the Epler Formation, is the major fault in this area. The fault surface dips south, and the maximum stratigraphic throw is about 4,000 feet. Displacement on the fault increases from west to east and reaches a maximum estimated to be several miles. Some of the displacement attributed here to the Kissell Hill Thrust may be caused by Triassic faulting, because Kissell Hill and the Cocalico Formation (which underlies it) extend eastward to Ephrata where rocks and faults of Triassic age are present.

North of Kissell Hill is the Fairland-Millway Thrust (Figure 6) which dips south and strikes east or northeast. Displacement on the fault probably exceeds 1 mile at the east end of its trace but may be negligible at the west end. Evidence for this thrust is the absence of stratigraphic section—part of the Millbach Formation is absent east of Lititz Run and the entire Richland Formation is absent west of Lititz Run. However, as the Richland is known to exist in the Lancaster quadrangle only at the east end of the Lititz belt, its occurrence elsewhere is doubtful and it may pinch out westward under the Fairland-Millway Thrust. East of the cross fault, along Lititz Run, the Fairland-Millway Thrust has migrated downsection and all stratigraphic units and the thrust-fault trace are offset to the south. This evidence suggests that the east block of the cross fault was uplifted.

Along the contact of the Cocalico Formation with the carbonate rocks, from Manheim northeastward to Clay, formations younger than the Stonehenge are absent in places (Plate 1). In some areas the units are absent as a result of the pre-Cocalico unconformity. In other areas the missing units have probably been sheared or faulted out during folding. These areas are shown on Plate 1 as thrusts.

In the zone of recumbent folding south and southwest of the Kissell Hill Thrust, folds occur that are interpreted as smaller digitations on the upper flank of the Manheim Anticline. Here, cleavage (Figure 5) and bedding strike east southeastward except in the area between Salunga and Mount Joy, where they turn sharply southward and the structural pattern is greatly disturbed.

The lower limb of the recumbent Florin Syncline north of Mount Joy (Figure 5) may be a southwestward extension of the upper limb of the Manheim Anticline. The recumbent Florin and Mount Joy Synclines (Figure 5) are interpreted as the same fold whose axial surface has been refolded into an open syncline that plunges eastward. Further south, an open anticlinal fold in cleavage and bedding that also plunges eastward is believed to have produced the curvature of the axial trace of the recumbent Mount Joy Syncline. These open folds are shown by the attitudes of generalized cleavage in Figure 5.

The overturned upper limb of the Mount Joy Syncline is also the lower limb of the recumbent Salunga Anticline (Figure 6). The apex and both

limbs of the recumbent anticline are exposed in the Pennsylvania Railroad cut at Salunga.

East of the apex of the Salunga Anticline, recumbent folding appears to be less intense than to the west. Perhaps much of the stress that produced recumbent folds in the Mount Joy area was relieved further east by displacement on the Mechanicsville Thrust. (Plate 2 and Figure 6). This thrust is interpreted as a southward-dipping fault that places the Buffalo Springs Formation in contact with the Stonehenge Formation at land surface across most of the quadrangle. Displacement on the fault apparently decreases west of Mechanicsville, as sandy dolomite lenses of the Buffalo Springs Formation and most of the Millbach Formation appear progressively westward in the section on the south side of the fault trace. The thrust fault may extend farther west than indicated on Plate 1 and Figure 6 but displacement must be slight, as a normal stratigraphic sequence is present.

North of the Mechanicsville Thrust, in the eastern half of the quadrangle, the dip of cleavage changes abruptly from north to south. This change is interpreted on the map of generalized cleavage (Figure 5) as an east-west trending synclinal axis and is probably the result of later folding of the axial-plane cleavage.

ZONE OF UPLIFT AND VARIABLE FOLDING

South of the Mechanicsville Thrust and the recumbent folds in the vicinity of Salunga and Mount Joy, the structural pattern is not entirely clear. Both complex and simple structures are present, but their genetic relationships to each other and to the zone of recumbent folding are not well understood.

Major structures in the eastern part of the zone are the Neffsville Anticline and the Eden Syncline. (Plate 2 and Figure 6). The Neffsville Anticline appears to be a broad anticlinal uplift. The cleavage syncline (Figure 5) north of the Mechanicsville Thrust may be the hinge on which the Neffsville Anticline was uplifted. In the crestal area, the Neffsville Anticline has been disrupted by numerous small faults. The south flank of the fold is downthrown by a large fault just south of the crestline.

The Eden Syncline is a broad open fold (Plate 2 and Figure 6), occurring south of the Neffsville Anticline. South of the Eden Syncline is a broad open anticline which extends westward to the vicinity of the Chestnut Hill Anticline (Figure 6).

The North Chestnut Hill Anticline, Chestnut Hill Anticline, Chickies Anticline, and the Chickies Thrust (Plate 2 and Figure 6) are the major structural features in the western part of the zone.

The eastward-plunging generalized axis of the North Chestnut Hill Anticline turns northeastward and strikes toward the Neffsville Anticline. The North Chestnut Hill Anticline is not a simple fold but rather a series of smaller folds whose northeast trend may indicate that it is earlier than the

Neffsville Anticline. Further indications of multiple folding in this zone can be seen in the Chickies Anticline, which contains tight isoclinal folds whose axial planes strike northeastward across the general easterly trend of the fold (Jonas and Stose, 1930, p. 58; Freedman, Wise, and Bentley, 1964).

The north flanks of the Chickies and Chestnut Hill Anticlines are bordered by the Chickies Thrust. Sharp curvature of the fault trace on the west side of the North Chestnut Hill Anticline is interpreted to be the result of an eastward-plunging anticlinal folding of the fault surface.

ZONE OF DOMINANTLY STEEP ISOCLINAL FOLDING

On the south side of the Lancaster quadrangle is a zone of steeply dipping cleavages that strike east or northeast. At the west end of this zone is a series of folds whose axial planes parallel the steep cleavage. The North Manor Hills Anticline (Plate 2 and Figure 6) is a good example of the style of folding that is dominant in this zone. The anticline is isoclinal, slightly overturned to the north, and has a steep southward-dipping axial plane parallel to cleavage.

Fold patterns north and northeast of the North Manor Hills Anticline suggest possible multiple folding in the zone of steep isoclinal folding. The western half of the Mountville Anticline, the Columbia Syncline, and two small folds north of the Mountville Anticline (in the vicinity of Donnerville) trend northeastward, whereas the eastern half of the Mountville Anticline trends east-west. Gently dipping cleavages, in addition to the more typical steep cleavages, suggest the possibility of two sets of cleavage. It is believed that the north-easterly trending fold system is earlier and may be related to recumbent folding farther north. Small refolded folds in outcrops of the Conestoga Formation also indicate that the steep isoclinal fold system has been superimposed on an earlier fold system.

South of the North Manor Hills Anticline the anticlinal folds are largely disrupted by faulting. Most of these faults are interpreted as steep southward-dipping reverse faults.

STRUCTURAL HISTORY

The structural history of the Lancaster quadrangle clearly is one of multiple events beginning early in the Paleozoic Era and ending in the Triassic period. The general sequence of these events, as interpreted by the authors, is discussed briefly in this section.

Epeirogenic movements that caused the pre-Conestoga and pre-Cocalico unconformities are the earliest structural events recorded in the carbonate rocks of the Lancaster quadrangle. These movements occurred between Middle Cambrian and Middle Ordovician time, according to the stratigraphic position of the unconformities.

Following the deposition of the Conestoga and Cocalico Formations, the first major deformation occurred. At this time, nappe structures and axial-plane cleavages were formed that dominate the structure in the zone of recumbent folding. The effects of this phase of deformation probably extend throughout the quadrangle, although little evidence of recumbent folding is visible in the carbonate rocks south of the zone of recumbent folding. However, according to Freedman, Wise, and Bentley (1964, p. 636–637), a single recumbent-fold pattern extends from a steeply dipping root zone in the southeastern Piedmont northward through the nappe structures of the Great Valley.

Most of the thrust faulting present probably occurred late in the period of recumbent folding or shortly thereafter. Minor thrusting or shearing on the overturned limb of the Manheim Anticline may have begun slightly earlier than on the large thrust faults. Strike-slip faulting and some local warping of the axial-plane cleavage may also have occurred during this time.

A second major deformational phase followed or perhaps overlapped the period during which thrust faulting occurred. In the southern part of the quadrangle, this deformation produced isoclinal or near isoclinal folds, steeply dipping axial-plane cleavage, and reverse faults. This pattern is the D_2 (second deformation) pattern reported by Freedman, Wise, and Bentley (1964) in the area south of the Chickies Anticline. They conclude that the pattern, which ". . . maintains a fairly constant strike and steep dip across the Maryland and Pennsylvania Piedmont suggests a deep seated regional origin." The more open folds, further north, such as the Eden Syncline and the Chestnut Hill Anticline, were probably formed during this phase of deformation. The Neffsville Anticline may also have been formed at this time. In the zone of recumbent folding, the effects of this phase of deformation appear as open folds in cleavage and bedding or broad arches such as the Brunnerville Arch.

The variability of fold types from broad open folds to tight isoclinal folds during this phase of deformation is probably the result of the behavior of different rock types under the same stresses and of local differences in the intensity of basement deformation. For example, in the zone of steep isoclinal folding, flowage in the limestones probably controlled the isoclinal forms of the folds. Further north, in the zone of uplift and variable folding, the intensity of deformation may have been as great, but the rocks are largely dolomite and quartzite that apparently reacted to the stresses mostly by flexing into open folds or by fracturing. In the zone of recumbent folding, where flexure folding also occurred, basement deformation was probably less intense than in the zone of isoclinal folding.

Following the second major phase of deformation, additional adjustments may have occurred. Faults as late as Triassic age are probably present in the carbonate rocks, although none have been identified as such.

GEOMORPHOLOGY

The area underlain by carbonate rocks in the Lancaster quadrangle has, for the most part, a gently rolling topography. Divides between perennial streams generally have a maximum altitude of between 400 and 480 feet above mean sea level. The larger streams flow generally southward and southwestward; the lower stream altitudes at the south and southwest edges of the quadrangle are approximately 230 to 290 feet above mean sea level. Hence, maximum relief on the carbonate rocks is no more than 250 feet. Local relief between hilltops and adjacent perennial streams is considerably lower, ranging from 20 feet to approximately 200 feet.

Relief is controlled by differences in the ability of the carbonate rocks to resist erosion. These differences are caused largely by variations in lithology and rock weaknesses having a structural origin. Average local relief on several stratigraphic units is given in the following table:

Stratigraphic unit	*Average local topographic relief (feet)*
Contestoga Formation	130
Epler Formation	45
Stonehenge Formation	40
Conococheague Group	75
Zooks Corner Formation	80
Ledger Formation	50
Kinzers Formation	80

The Conestoga Formation has much greater local relief and is generally much more finely dissected than the other carbonate rocks (Plate 1). These marked differences may reflect lithologic contrasts that are emphasized by the near vertical dip of cleavage and bedding generally present in the Conestoga Formation.

Relief on the Epler, Stonehenge, and Ledger Formations is of similar magnitude and lower than on the other stratigraphic units. The low relief probably results from the relatively uniform ability of these units to resist erosion. The inclusion of the Epler Formation in this group appears anomalous at first, as it is an interbedded limestone and dolomite unit. However, a comparison of the average local topographic relief on the Epler with relief on the interbedded limestones and dolomites of the Conococheague Group suggests that the noncarbonate, rather than the carbonate, components cause significant differences in the resistance of these rocks to erosion. The Epler Formation contains little noncarbonate material whereas abundant clay, silt, and quartz sand is dispersed heterogeneously through the Conococheague Group. A similar comparison can be made between the Ledger and Zooks Corner Formations. Although both are dolomite units, the Ledger forms valleys and has low relief whereas the Zooks Corner forms ridges and has much greater relief. The significant lithologic component causing differ-

ences in resistance to erosion of these units again appears to be the noncarbonate materials in the rocks. The Ledger lacks noncarbonate materials, whereas the Zooks Corner contains an abundance of such material distributed heterogeneously. The relatively great relief on the Kinzers Formation can be similarly attributed to the heterogeneous distribution of concarbonate material through the formation.

The landforms in the quadrangle are due principally to stream sculpture on carbonate rocks of varying resistance to erosion. Although many sinkholes exist in the area, neither sinkholes nor other closed depressions are prominent elements of topography. Even in the Lititz-Manheim Valley, where large areas are devoid of surface streams, long continuous stream channels predominate and closed basins are rare.

The drainage pattern in the Lancaster quadrangle is almost entirely dendritic and appears to be only slightly controlled by structure or lithology of the rocks. A small area (approximately 2 square miles) 2½-miles northwest of Lititz does have a distinct trellis pattern that may be controlled by jointing. In addition, a study of over 300 straight segments of stream channels shows appreciable geologic control of local channel orientations. Two major channel directions are present; one is parallel to the strike of bedding, and a second is approximately perpendicular to the strike of bedding. Because of wide variations in strike, graphic plots (not shown) of channel orientations throughout the Lancaster quadrangle do not show the two major directions. However, in the area south of the quartzite ridge (Chestnut Hill, Blossom Hill, etc.), strike is fairly uniform and the two major channel orientations can be shown in a frequency distribution diagram (Figure 7). The more

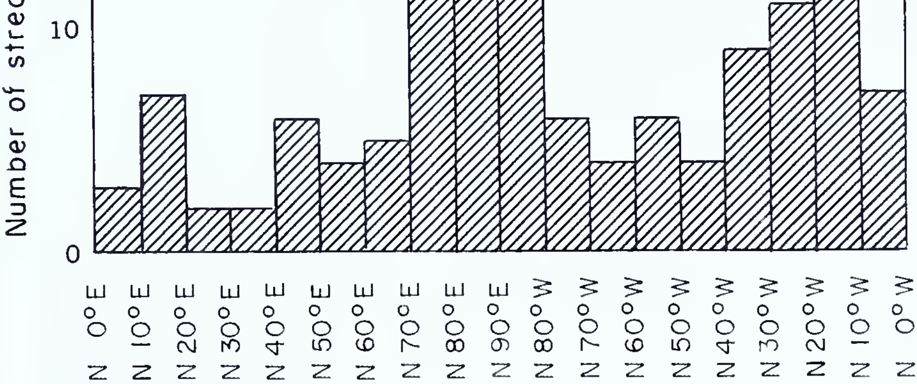


Figure 7. Graph showing frequency distribution of orientation of stream channel segments in the area south of the quartzite ridges.

prominent channel orientation (N 70°–80°E) coincides with the strike of bedding and cleavage. The less prominent orientation (N 10°–20°W) is approximately perpendicular to the strike of bedding and may be related to a joint system in the rocks.

Because of the partial control of bedding upon stream channel orientations and the relatively large topographic relief of the Kinzers Shale, Zooks Corner Formation, and the Conococheague Group, these units form prominent ridges parallel to strike. Some strike ridges occur also on the Conestoga and Epler Formations. The Vintage, Ledger, and Stonehenge Formations, on the other hand, generally form lowlands, rather than ridges.

HYDROLOGY

PRINCIPLES

Ground water is the subsurface water in that part of the zone of saturation in which all the interconnected pores, crevices, and voids in the rock are filled with water under pressure equal to or greater than atmospheric. Rocks that are capable of yielding usable supplies of ground water to wells or springs are called aquifers. The openings that contain and transmit water in an aquifer are classified as primary and secondary. Primary openings are the interstitial voids formed during deposition of the sediments. The secondary openings are formed as a result of crustal movements, solution, or rock-weathering processes that take place after the rock is formed.

Ground water in the carbonate rocks of the Lancaster quadrangle occurs almost entirely in the secondary openings. Water-filled openings along bedding and cleavage planes, joints, and faults can supply small to moderate amounts of water for domestic and farm use. Where these openings have been enlarged by solution, larger amounts of water are available for industrial and municipal use. The number and size of the openings and the degree of interconnection between them determine the ability of the carbonate rocks to store water and to transmit it to wells and springs.

Ground water is customarily divided into two classes: (1) that which occurs under artesian conditions, and (2) that which occurs under water-table conditions. Under water-table conditions, ground water is not confined, and the upper surface of the zone of saturation, called the water table, is free to fluctuate. Where ground water is confined under hydrostatic pressure in a permeable rock by relatively impermeable overlying rocks, the water is under artesian conditions. When an artesian aquifer is penetrated by a well, the water will rise in the well above the upper surface of the aquifer to a level called the piezometric surface.

In the carbonate rocks of the Lancaster quadrangle, ground water is confined within crevices and solution openings, the rock walls of the channels acting as the impermeable confining material. When a well penetrates such

a water-bearing opening, the water will rise in the well above the level of the opening and, thus, might be considered artesian. However, as there are no sharply defined aquifers or confining beds, the carbonate rocks should not be thought of as artesian aquifers but rather as one complex, nonhomogeneous water-table aquifer.

Precipitation is the source of all ground water in the Lancaster quadrangle. The precipitation infiltrates downward through the soil and rock openings to the zone of saturation. Ground-water recharge takes place over most of the area underlain by the carbonate rocks but is greatest where surface runoff enters the ground through dry stream valleys and sinkholes. Within the zone of saturation, ground water moves, under the influence of gravity, downward and laterally through rock openings from areas of recharge (where hydraulic potentials are high) to points of discharge (where hydraulic potentials are low). Ground-water discharges primarily through seeps and springs into streams. Base flow of perennial streams such as Chickies, Little Conestoga, and Conestoga Creeks is maintained by ground-water discharge.

Under natural conditions and over long periods of time, the amount of water discharged from the zone of saturation is equal to the amount of water recharged to the zone of saturation. Ground-water levels fluctuate in response to recharge and discharge—rising when recharge exceeds discharge and declining when discharge exceeds recharge.

WATER-BEARING PROPERTIES OF THE CARBONATE ROCKS

The carbonate rock formations of the Lancaster quadrangle differ greatly in their capability to store and transmit water. Pumping tests of 1-hour duration were made on 247 wells in order to evaluate the ability of the various carbonate rock formations to supply water to wells. The results of the tests are given in Table 9 as the specific capacity of each well after 1-hour of pumping. The specific capacity of a well is the yield of a well in gallons per minute per foot of drawdown. Drawdown is the difference in feet between the static water level and the pumping water level. Plate 1 shows the distribution of specific capacities in the area studied.

These calculated specific capacities have two shortcomings. First a 1-hour test may be inadequate to determine the performance of a well over long periods. Second, the wells in most cases were pumped at relatively low rates, generally between 5 and 15 gpm. In an aquifer as heterogenous as the carbonate rocks, the specific capacity of a well determined at a low pumping rate is generally higher than the well's specific capacity at a much higher pumping rate. Because of these shortcomings, yields of wells penetrating carbonate rocks cannot be computed from specific capacity data as can yields of wells penetrating more homogeneous, isotropic aquifers of wide areal extent.

The principal use of these specific capacities is to permit comparison be-

tween wells that tap different lithologies, are in different geologic units, are situated in different topographic locations, or are drilled to different depths. In addition, specific capacities are useful in indicating, in a general way, the suitability of wells for various purposes. Wells in the carbonate rocks that have specific capacities of less than 0.08 are generally inadequate or barely adequate for domestic use. Specific capacities of 0.08 or greater are generally sufficient for domestic use. Wells having specific capacities of 0.5 or greater are generally suitable for small public supplies and some industries. Wells having specific capacities of 5 or greater are generally suitable for public supply and industrial use.

Specific capacities of the 247 wells tested range from 0.02 to 600 gpm per ft. The mean and median specific capacities are 19 and 0.91 gpm per ft, respectively. The cumulative frequency distribution of specific capacities is shown in Figure 8. Eighty-three percent of the specific capacities are greater than 0.08 (the minimum considered suitable for domestic use) 58 percent are greater than 0.5 (the minimum considered sufficient for small public supply systems and some industries) and 25 percent are greater than 5.0 (the minimum sufficient for public supply systems and industrial use).

Cumulative frequency distributions of specific capacities from each formation (Figures 9, 10, 11 and 12) form the basis for an evaluation of the capability of each formation to supply sufficient water to wells for (a) domestic use, (b) small public supply, or (c) public supply and industrial use. In the discussion that follows each formation is evaluated as an excellent, very good, good, fair, or poor source of ground water for each use category. An excellent source is defined as 81 to 100 percent of the wells having specific capacities greater than the minimum specific capacity considered sufficient for that type of use (0.08 for domestic, 0.5 for small public supply, 5.0 for public supply). Very good is defined as 61 to 80 percent, good as 41 to 60 percent, fair as 21 to 40 percent, and poor as 0 to 20 percent.

Many of the cumulative frequency-distribution plots of specific capacity (Figures 8 through 15) show a change in slope of the curve for specific capacities less than 0.1. This change in slope occurs because these distributions contain a relatively large number of specific capacities that are less than 0.1, and the effect of borehole storage has not been subtracted from specific capacity. Borehole storage provides a major portion of the yield used in computing the specific capacity of low-yielding wells. For example, the specific capacity of a 6-inch diameter well, pumped for 1-hour, that yields only from borehole storage is about 0.025. Reasons for other changes in slope in the frequency-distribution plots could not be attributed to individual factors and are probably the result of the relatively small size of the samples.

Vintage Formation

The Vintage Formation is an unimportant source of water in the Lancaster quadrangle because of its small areal extent.

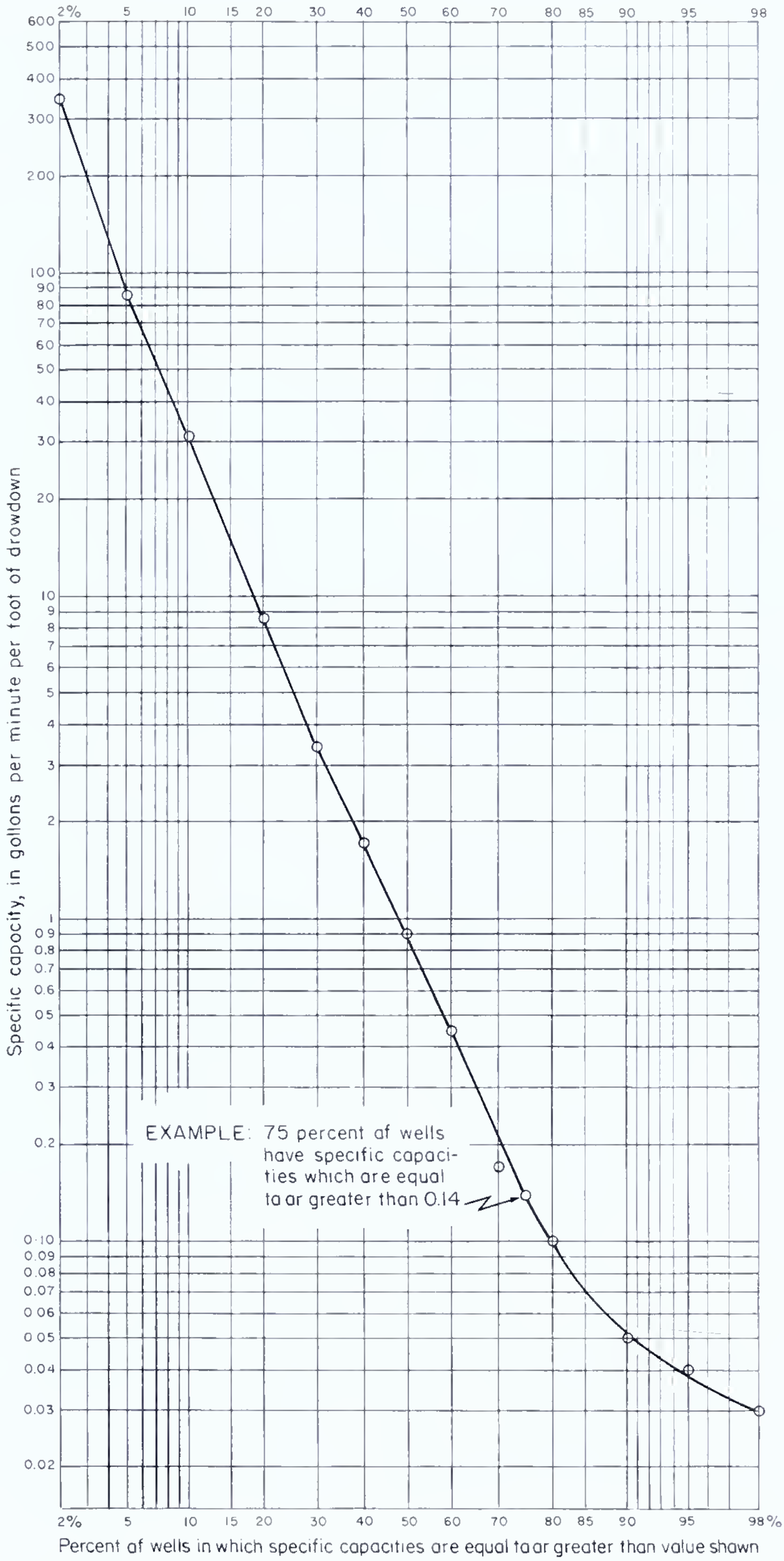


Figure 8. Graph showing the cumulative frequency distribution of specific capacities of 247 wells penetrating the carbonate rocks.

Specific capacities of seven wells in the Vintage Formation range from 0.12 to 74 gpm per ft. The mean specific capacity is 12 and the median is 0.44. The frequency distribution of specific capacities is shown in Figure 9.

Evaluation of Vintage Formation

Domestic use	Excellent
Small public supply	Good
Public supply or industrial use	Fair

Kinzers Formation

The Kinzers Formation is an unimportant source of water in the Lancaster quadrangle because of its small areal extent.

Specific capacities of 10 wells in the formation range from 0.05 to 38 gpm per ft. The mean specific capacity is 7.8 and the median is 1.0. The frequency distribution of specific capacities is shown in Figure 9.

Evaluation of Kinzers Formation

Domestic use	Excellent
Small public supply	Very good
Public supply or industrial use	Fair

Ledger Formation

Thirty pumping tests made in the Ledger Formation indicate that it is the highest yielding formation of Cambrian age in the Lancaster quadrangle. Specific capacities range from 0.16 to 130 gpm per ft. The mean specific capacity is 13 and the median is 2.5. The frequency distribution of specific capacities is shown in Figure 10.

Evaluation of Ledger Formation

Domestic use	Excellent
Small public supply	Excellent
Public supply or industrial use	Fair

Zooks Corner Formation

Twenty-four pumping tests in the Zooks Corner Formation indicate that it is one of the lower yielding carbonate-rock formations in the Lancaster quadrangle. Specific capacities range from 0.04 to 46 gpm per ft. The mean specific capacity is 2.5 and the median is 0.12. The frequency distribution of specific capacities is shown in Figure 10.

Evaluation of Zooks Corner Formation

Domestic use	Very good
Small public supply	Fair
Public supply or industrial use	Poor

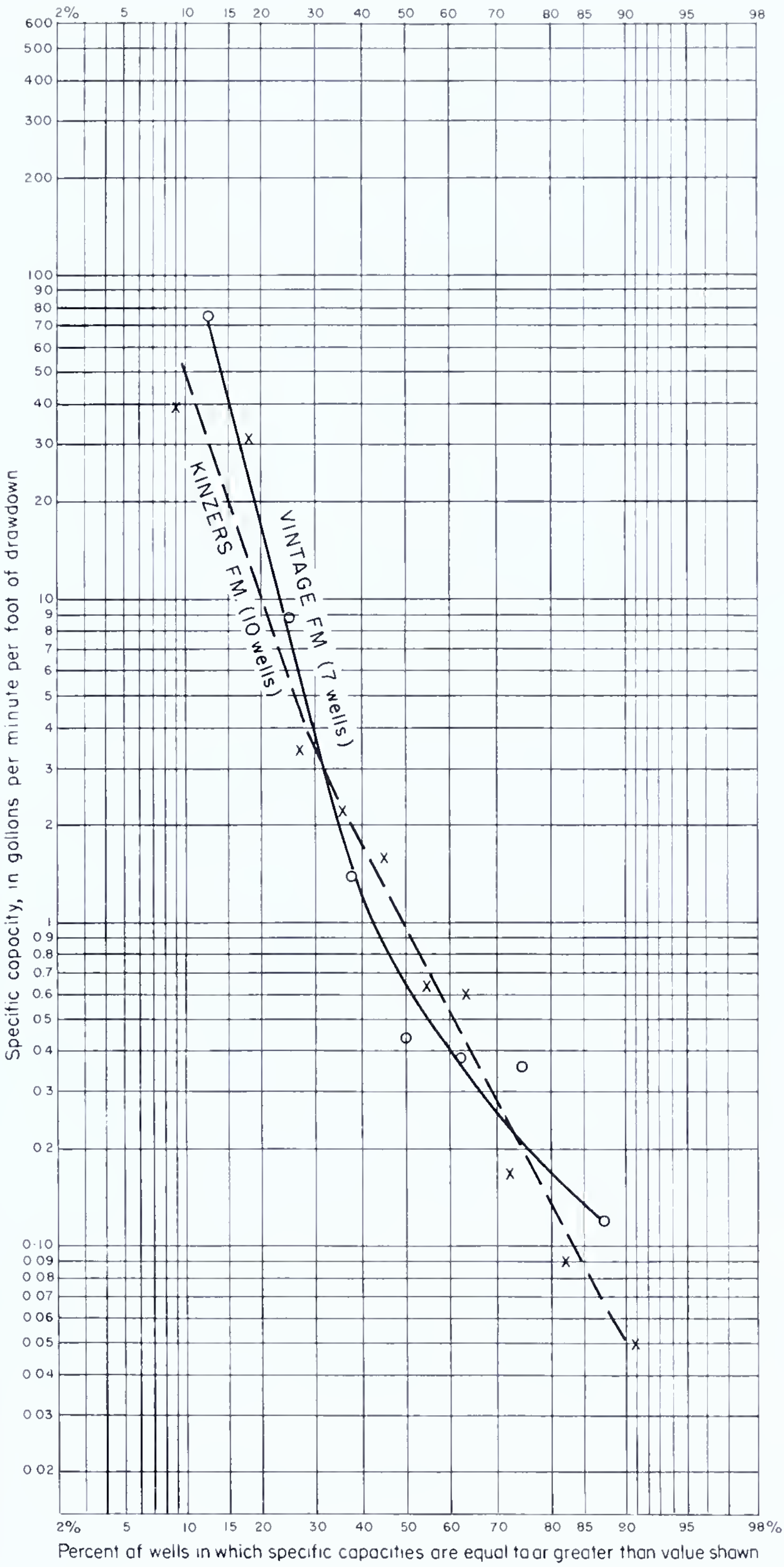


Figure 9. Graph showing the cumulative frequency distribution of specific capacities of wells penetrating the Vintage and Kinzers Formations.

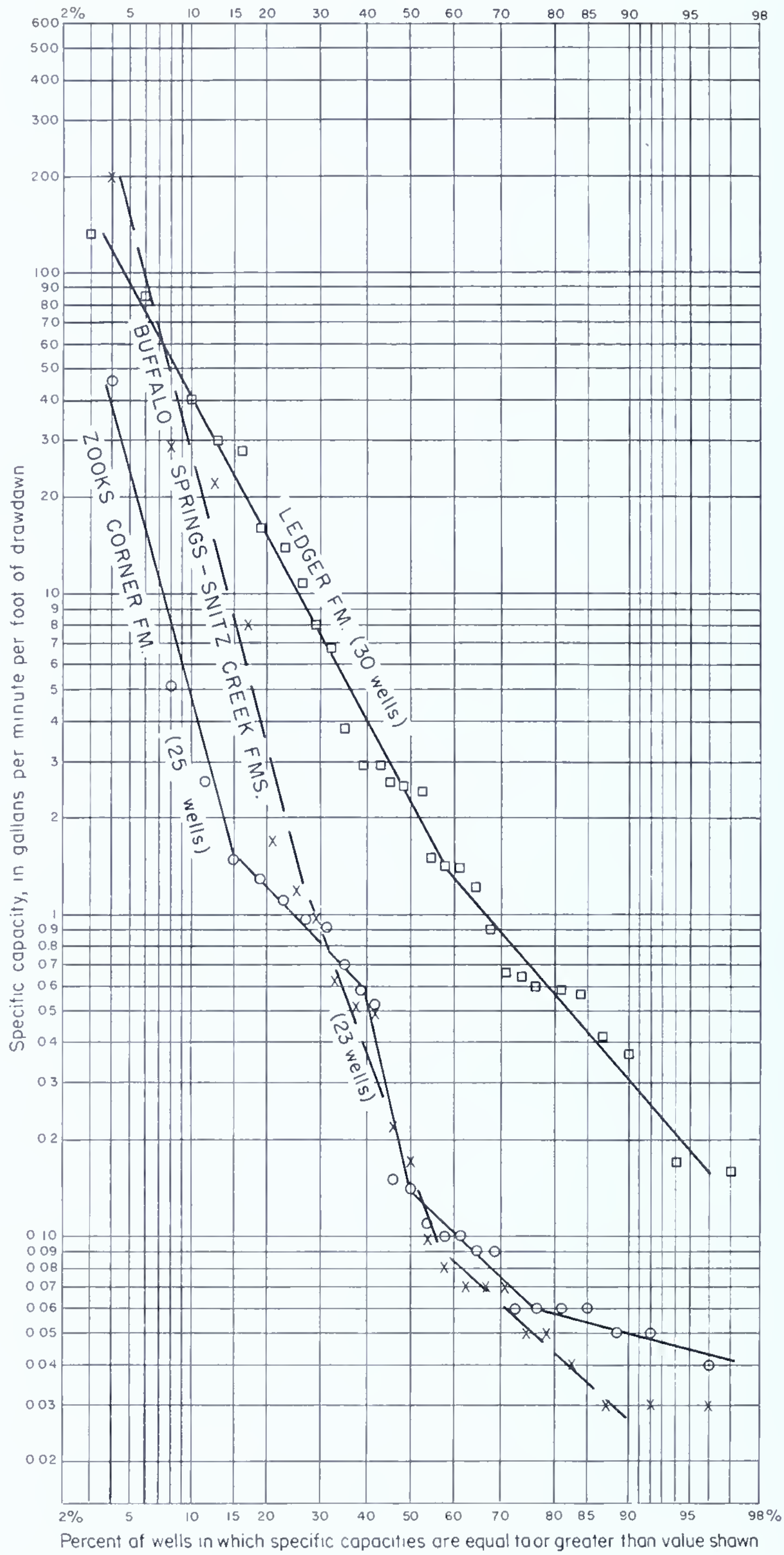


Figure 10. Graph showing the cumulative frequency distribution of specific capacities of wells penetrating the Ledger, Zooks Corner, Buffalo Springs, and Snitz Creek Formations.

Buffalo Springs and Snitz Creek Formations

Specific capacities of 24 wells in the Buffalo Springs Formation and the Buffalo Springs-Snitz Creek Formations undivided (no specific capacities are available from the Snitz Creek Formation) range from 0.03 to 200 gpm per ft. The mean specific capacity is 11 and the median is 0.2.

Evaluation of the Buffalo Springs Formation and the Buffalo Springs-Snitz Creek Formations undivided

Domestic use . . . . Very good
Small public supply . . . . Fair
Public supply or industrial use . . Poor

Millbach Formation

The Millbach Formation is one of the lower yielding carbonate-rock formations in the Lancaster quadrangle. Specific capacities of six wells range from 0.02 to 1.6 gpm per ft. The mean and median specific capacities are 0.5 and 0.14, respectively. The frequency distribution of specific capacities is shown in Figure 11.

Evaluation of Millbach Formation

Domestic use . . . . Very good
Small public supply . . . . Fair
Public supply or industrial use . . Poor

Richland Formation

The Richland Formation is an unimportant source of water in the Lancaster quadrangle because of its small areal extent. It is also one of the lower yielding carbonate rocks in the Lancaster quadrangle. Specific capacities of five wells range from 0.03 to 6.3 gpm per ft. The mean specific capacity is 1.4 and the median is 0.14. The frequency distribution of specific capacities is shown in Figure 11.

Evaluation of Richland Formation

Domestic use . . . . Good
Small public supply . . . . Fair
Public supply or industrial use . . . . . Poor

Stonehenge Formation

The Stonehenge Formation is the highest yielding carbonate-rock formation in the Lancaster quadrangle. Specific capacities of 17 wells range from).07 to 500 gpm per ft. The mean specific capacity is 121 and the median is 2. The frequency distribution of specific capacities is shown on Figure 11.

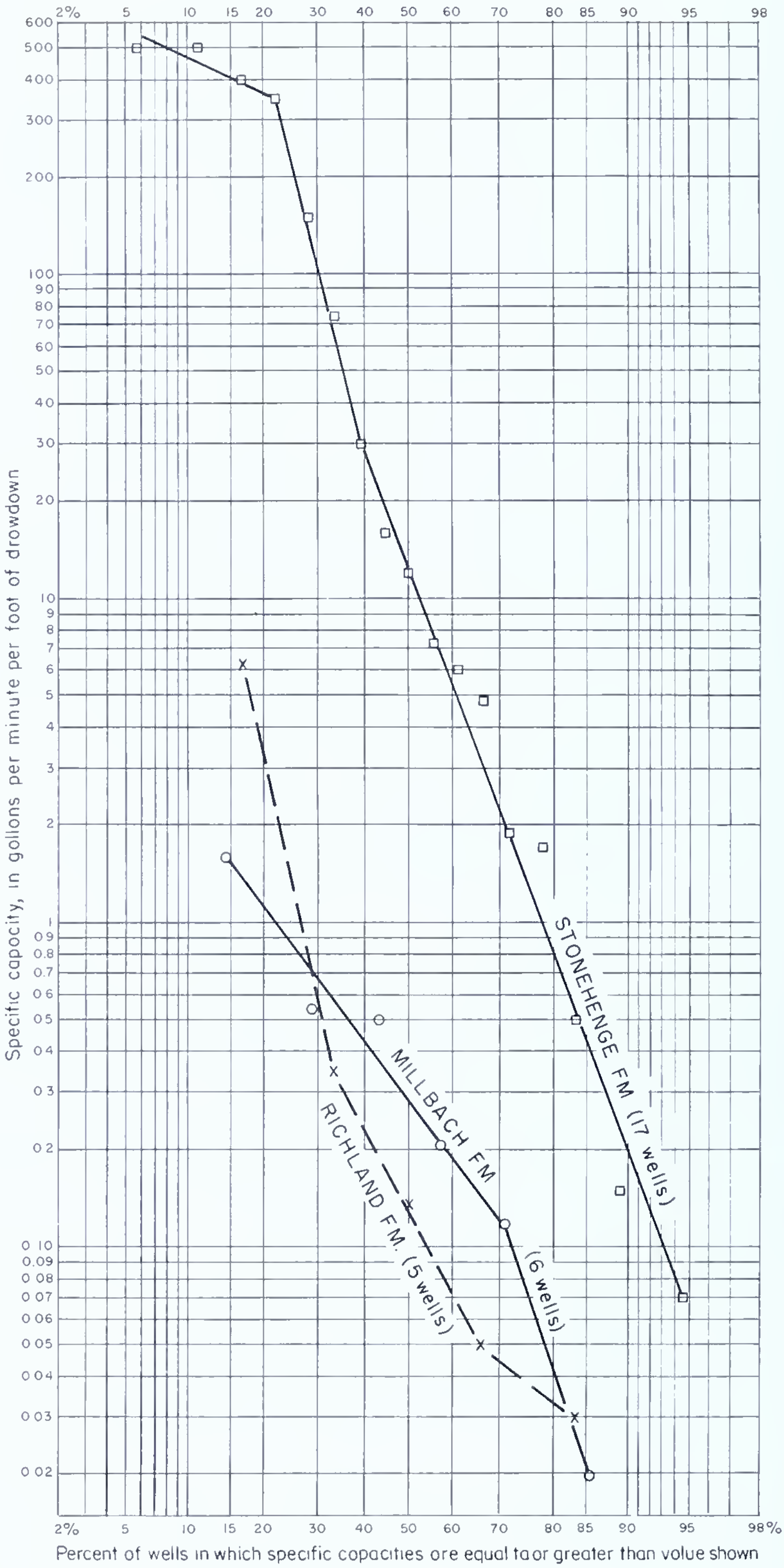


Figure 11. Graph showing the cumulative frequency distribution of specific capacities of wells penetrating the Millbach, Richland, and Stonehenge Formations.

Evaluation of Stonehenge Formation

Domestic use	Excellent
Small public supply	Excellent
Public supply or industrial use	Very good

Specific capacities of Stonehenge wells appear to be generally higher in the Lititz belt than in the Mount Joy belt. An evaluation of these areas is given below.

Aerial evaluation of the Stonehenge Formation

	Mount Joy belt	*Lititz belt*
Domestic use	Excellent	Excellent
Small public supply	Very good	Excellent
Public supply or industrial use	Good	Very good

Epler Formation

Specific capacities of 50 wells in the Epler Formation range from 0.03 to 600 gpm per ft. The mean specific capacity is 21 and the median is 0.50. The frequency distribution of specific capacities is shown in Figure 12.

Evaluation of Epler Formation

Domestic use	Very good
Small public supply	Good
Public supply or industrial use	Fair

Specific capacities of Epler wells appear to be generally higher in the Mount Joy belt than in the Lititz belt. An evaluation of the Epler Formation in these areas is given below.

Areal evaluation of the Epler Formation

	Mount Joy belt	*Lititz belt*
Domestic use	Excellent	Very good
Small public supply	Good	Fair
Public supply or industrial use	Fair	Poor

Ontelaunee, Annville, and Myerstown Formations

The Ontelaunee, Annville, and Myerstown Formations are unimportant sources of water in the Lancaster quadrangle because of their very small areal extent.

Two wells in the Ontelaunee Formation have specific capacities of 0.10 and 2.2 gpm per ft. One well penetrating both the Annville and Ontelaunee Formations has a specific capacity of 0.16. The specific capacity of one well in the Myerstown Formation is 0.2.

Conestoga Formation

Specific capacities of 63 wells in the Conestoga Formation range from

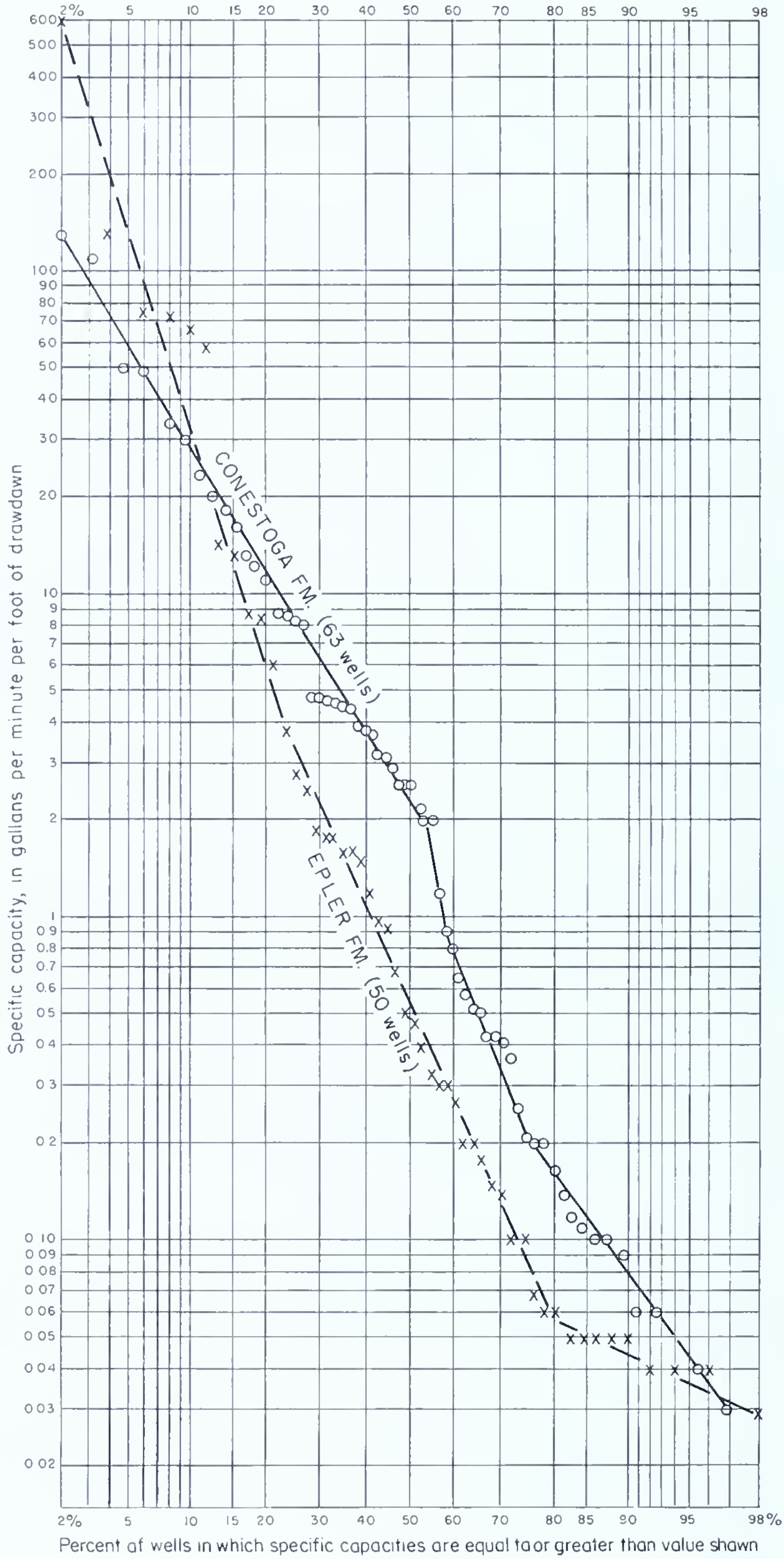


Figure 12. Graph showing the cumulative frequency distribution of specific capacities of wells penetrating the Epler and Conestoga Formations.

0.02 to 130 gpm per ft. The mean specific capacity is 9.9 and the median is 2.6. The frequency distribution of specific capacities is shown in Figure 12.

Evaluation of Conestoga Formation

Domestic use	Excellent
Small public supply	Very good
Public supply or industrial use	Fair

Relation of Specific Capacity to Lithology

The stratigraphic divisions of the carbonate rocks are based primarily on lithologic differences. Therefore, a relationship between specific capacity and stratigraphy is also a relationship between specific capacity and lithology.

When the cumulative frequency-distribution plots of specific capacity for each stratigraphic unit are analyzed in relation to the lithologic character of the unit, several lithologic characteristics appear to be significant in determining the yield capabilities of the carbonate rocks. These characteristics are: (1) the species of carbonate rocks (limestone or dolomite), (2) the amount of noncarbonate clay, silt, and sand present, and (3) the coarseness of crystallinity of the rock.

Cumulative frequency distributions of specific capacities for stratigraphic units grouped according to the species of carbonate rock (Table 1) have median specific capacities of 2.6 for limestone units, 0.91 for dolomite units, and 0.33 for interbedded limestone and dolomite units. However, plots of the distributions (not shown) do not fully support the relationships implied by the median specific capacities. Distribution plots of specific capacities for dolomite units and for interbedded limestone and dolomite units do not show any clear relationship. In contrast, the plot of specific-capacity distributions for limestone units is sufficiently different from the other categories to suggest that limestones may have greater yield capabilities than dolomite or interbedded limestone and dolomite.

Figure 13 shows the cumulative frequency distribution of specific capacities for stratigraphic units grouped in two categories, according to their relative amounts of noncarbonate clay, silt, and sand, as determined by field observations. The Conestoga Formation was excluded from the distributions because of uncertainty concerning the amount of noncarbonate clay, silt, and sand in the unit. The median specific capacity is 1.5 for wells in units having a relatively low noncarbonate content and is .22 for wells in units having a relatively high noncarbonate content. Therefore, the presence of noncarbonate clay, silt, and sand apparently reduces the yield capabilities of carbonate rocks.

The Ledger Formation has a very low noncarbonate content relative to the other stratigraphic units, but it is also generally coarsely or very coarsely crystalline. Therefore, either or both of these lithologic characteristics probably are important factors that contribute to the relatively high yield capability of the Ledger.

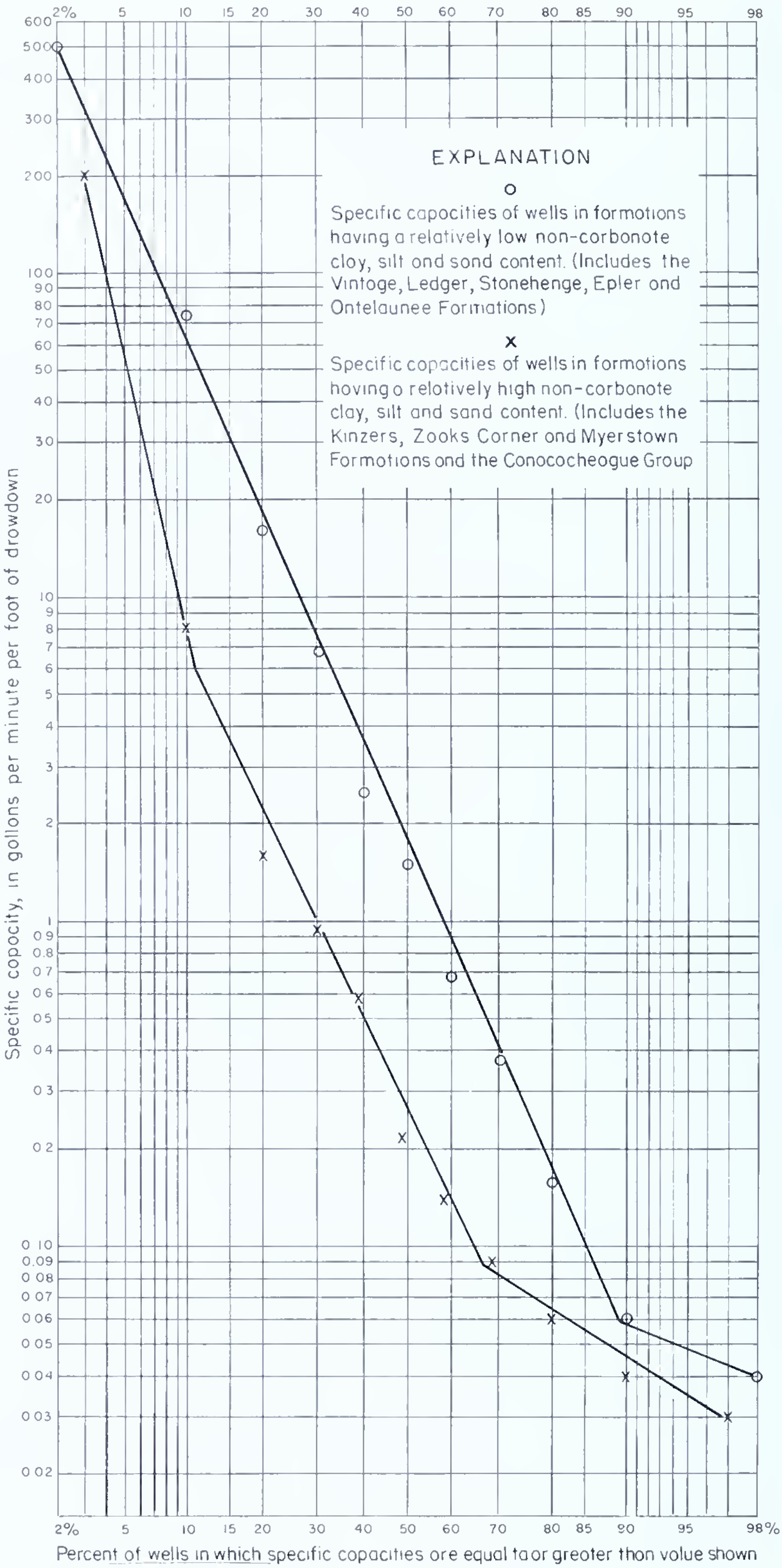


Figure 13. Graph showing the cumulative frequency distribution of specific capacities for stratigraphic units grouped according to their relative amounts of noncarbonate clay, silt, and sand.

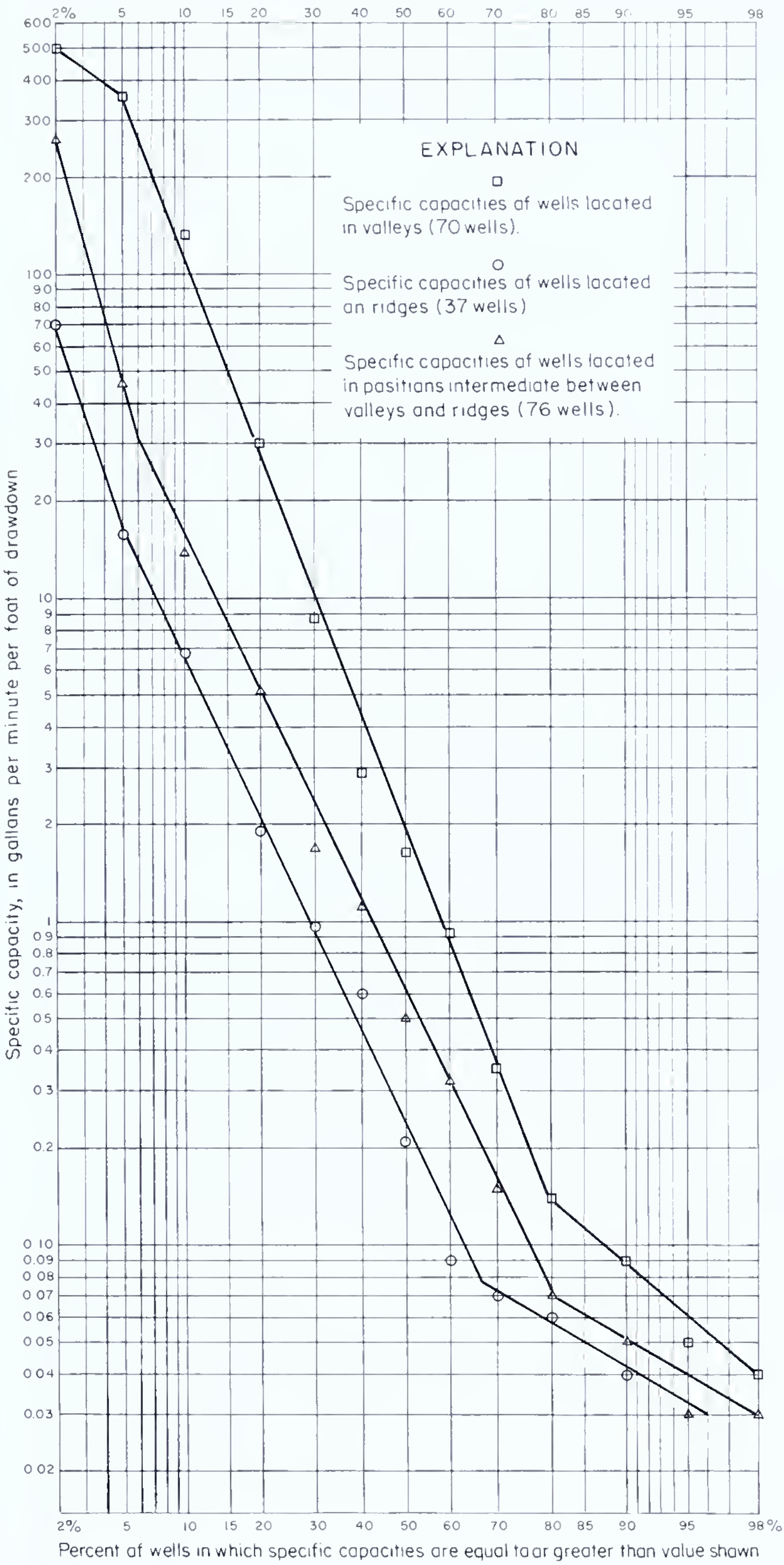


Figure 14. Graph showing the cumulative frequency distribution of specific capacities of wells grouped according to topographic position.

Relation of Specific Capacity to Topography

Specific capacity appears to be related to the topographic position of wells. Figure 14 shows cumulative frequency distribution plots of specific capacity for wells grouped according to topographic position. Wells in the Conestoga Formation are not included in the plots because the topography of this formation is not readily divisible into positions similar to the other carbonate formations. The plots in Figure 14 indicate generally that the specific capacities of wells in valleys are greater than those of wells in topographic positions intermediate between valleys and ridges, and that specific capacities are least in wells on ridges.

Probably the clearest indication of differences between the specific capacities of wells in the three topographic positions is the distribution of wells having high specific capacities. Thirteen of the 18 wells having specific capacities greater than 50 gpm per ft are in valleys, 4 are intermediate in position, and only 1 is on a ridge. Of 11 wells having specific capacities greater than 100 gpm per ft, 8 are in valleys, 3 are in intermediate positions, and none are on ridges.

A similar general relationship exists between specific capacity and topography for individual stratigraphic units. Although the plotted distributions are not shown, the results are summarized in Table 5.

Only the Zooks Corner Formation appears to show an anomalous relationship between specific capacity and topography. Wells in either valley or ridge positions have median specific capacities that are almost identical to each other and lower than for wells in intermediate positions. However, 6 of the 7

Table 5. *Median specific capacity of wells separated by stratigraphic unit and grouped according to topographic position*

	Valley positions		Intermediate positions		Ridge positions	
Stratigraphic unit	Median[1] specific capacity	Number of wells	Median[1] specific capacity	Number of wells	Median[1] specific capacity	Number of wells
All units[2]	1.6	70	0.5	76	0.21	37
Stonehenge Formation	74	11	6	3	1.7	3
Ledger Formation	2.6	17	2.5	8	.67	5
Epler Formation	1.7	18	.51	23	.06	9
Conococheague Group	.45	14	.17	13	.08	7
Zooks Corner Formation	.1	7	.9	11	.09	7

[1] Specific capacity in gallons per minute per foot of drawdown.

[2] Excludes Conestoga Formation.

wells in valley positions are in narrow valleys that cut sharply into the ridges that generally form on the Zooks Corner Formation. Therefore, these valleys may not be comparable to the broad valleys usually formed on the other stratigraphic units analyzed in Table 5.

Relation of Specific Capacity to Structure

Attempts to relate specific capacity to the position of wells with respect to folds or faults were unsuccessful. Preliminary studies of well locations on or near fracture traces visible on aerial photographs failed to indicate that such wells have specific capacities greater than those for wells in other locations. Therefore, the relationships of well yields to fracture traces was not investigated further.

No attempt was made to compare specific capacities of wells in different structural zones, because differences in stratigraphy between zones would mask any relationships. Areal differences in the Stonehenge and Epler Formations occur within the zone of recumbent folding and may be related to either structure or lithology.

Relation of Specific Capacity to Depth of Wells

Specific capacities of wells in the carbonate rocks appear to be inversely related to the depths of the wells. Figure 15 shows the cumulative frequency distribution of specific capacities of wells grouped according to their depth.

Table 6. *Median specific capacities of wells separated by stratigraphic unit and grouped according to well depth*

	0 to 99 feet[1]		100 to 199 feet[1]		200 to 600 feet[1]	
Stratigraphic unit	Median[2] specific capacity	Number of wells	Median[2] specific capacity	Number of wells	Median[2] specific capacity	Number of wells
All units	2.9	83	0.51	81	0.08	32
Stonehenge Formation	16	9	21	4	3.25	2
Ledger Formation	2.9	19	.5	6	.67	3
Conestoga Formation	3.4	22	2.4	18	.11	7
Epler Formation	5.1	8	.49	24	.1	7
Conococheague Group	4.6	8	.28	12	.04	6
Zooks Corner Formation	.96	5	.14	12	.06	5

[1] Depth of wells below land surface.

[2] Gallons per minute per foot of drawdown.

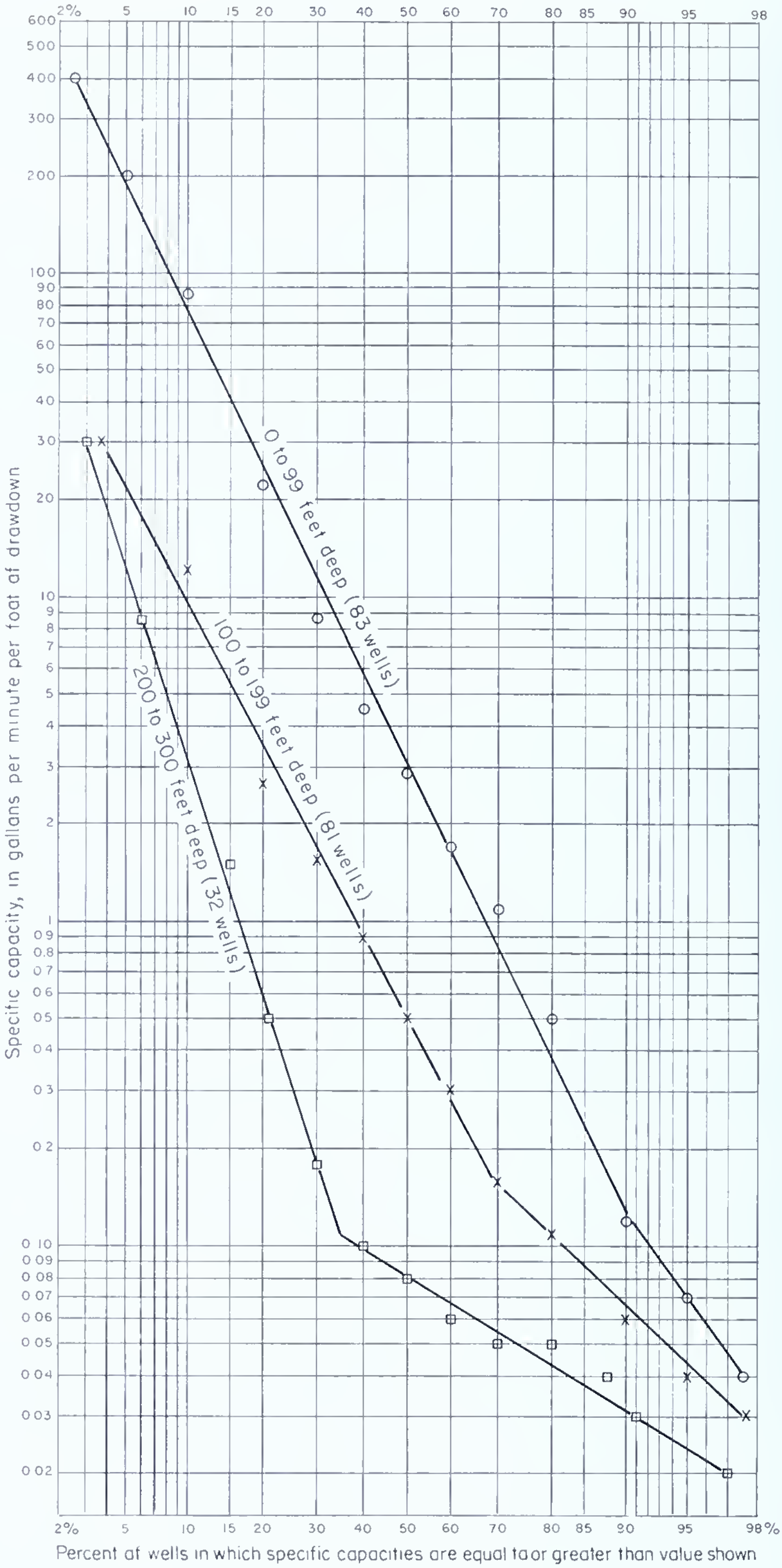


Figure 15. Graph showing the cumulative frequency distribution of specific capacities of wells grouped according to depth.

In general, shallow wells have the higher specific capacities and deeper wells have the lower specific capacities. This relationship is shown also in Table 6, which gives the median specific capacity for wells grouped according to depth. The median specific capacity, for all units combined, decreases from 2.9 for wells less than 100 feet deep to 0.08 for wells more than 200 feet deep. The same inverse relationship of specific capacity to depth of wells is shown in Table 6 for individual stratigraphic units, although some exceptions in the trend do occur. Such exceptions are probably caused by the small size of the sample and, therefore, do not necessarily reflect the actual distribution of specific capacities with well depth.

This relationship of specific capacity to well depth indicates that for wells that encounter insufficient supplies of water (for the intended use) at depths less than 200 feet, deepening the well is less likely to provide the needed water than drilling another well.

GROUND WATER CONTRIBUTION TO STREAMFLOW

The average discharge of Little Conestoga Creek at the Conestoga Country Club (38.2 square mile drainage area) for the period January 1964 through December 1964 was 43 cfs (1.13 cfs per sq mi of drainage basin). Based on a study of streamflow hydrographs of runoff peaks and antecedent flow, ground-water discharge is estimated to be 33 cfs (0.86 cfs per sq mi of drainage basin). Ground-water discharge constitutes approximately 77 percent of the total streamflow.

SPECIFIC YIELD IN THE LITTLE CONESTOGA CREEK BASIN

Specific yield is a measure of the storage capacity of an aquifer and is defined as the ratio of the volume of water that will drain from a saturated rock to the total volume of dewatered rock. This parameter is called gravity yield by Olmsted and Hely (1962). The average specific yield (SY) of the carbonate rocks within the Little Conestoga Creek drainage basin above the Conestoga Country Club can be determined from the equation (Meisler, 1963, p. 32)

$$q = R + (\Delta V \times SY) \tag{1}$$

where

- q is the quantity of ground-water discharged from the basin into Little Conestoga Creek above the Conestoga Country Club during a given time interval,
- R is the total quantity of recharge added to the rocks within the ground-water basin during the time interval, and
- ΔV is the change in volume of unwatered rock during the time interval.

During periods of no recharge equation (1) becomes

$$q = \Delta V \times SY \tag{2}$$

Periods of several days length, during which no precipitation or snow melting took place, were assumed to be periods of no recharge. Each period was started at least three days after a rainfall in order to allow direct surface runoff to leave the basin. Thus, the entire stream discharge at the Conestoga Country Club during these periods was assumed to be ground-water discharge and was determined by applying known stage-discharge relations to stage-recorder charts. The calculations of specific yield for two of the periods are shown below:

August 23–24, 1964

$q = 8.4$ cfs $= 50.8 \times 10^5$ ft^3 of water in 7 days

$\Delta V = 0.18$ ft (average 7-day decline in four wells) $\times 1.06 \times 10^9$ ft^2 (area of basin)

$$SY = \frac{50.8 \times 10^5 \text{ ft}^3}{0.191 \times 10^9 \text{ ft}^3} = 0.027$$

June 5–12, 1966

$q = 15.3$ cfs $= 105.8 \times 10^5$ ft^3 of water in 8 days

$\Delta V = 0.16$ ft (average 8-day decline in four wells) $\times 1.06 \times 10^9$ ft^2 (area of basin)

$$SY = \frac{105.8 \times 10^5 \text{ ft}^3}{0.170 \times 10^9 \text{ ft}^3} = 0.062$$

Ideally, ΔV should be determined from water-level maps constructed at the beginning and end of each period used. Because data to construct such maps were not available, ΔV was determined by multiplying the area within the ground-water basin by the average decline in water level in four widely-spaced observation wells in the basin. The accuracy of the calculated specific yield depends upon how closely the average water-level decline in the four observation wells approximates the average water-level decline in the entire basin.

The approximate average specific yield of the zone of water-table fluctuation in the carbonate rocks of the Little Conestoga Creek drainage basin above the Conestoga Country Club, as calculated from 11 periods ranging in length from 5 to 14 days of no precipitation, is .04 or 4 percent. Specific yields calculated by similar methods in some other areas in Pennsylvania are as follows: carbonate rocks of the Lebanon Valley, 5 percent (Meisler, 1963); Brandywine Creek Basin, 7.0 percent (Olmsted and Hely, 1962).

WATER-LEVEL FLUCTUATIONS

Ground-water levels fluctuate in response to recharge and discharge. Water levels rise when recharge exceeds discharge (during periods of rain-

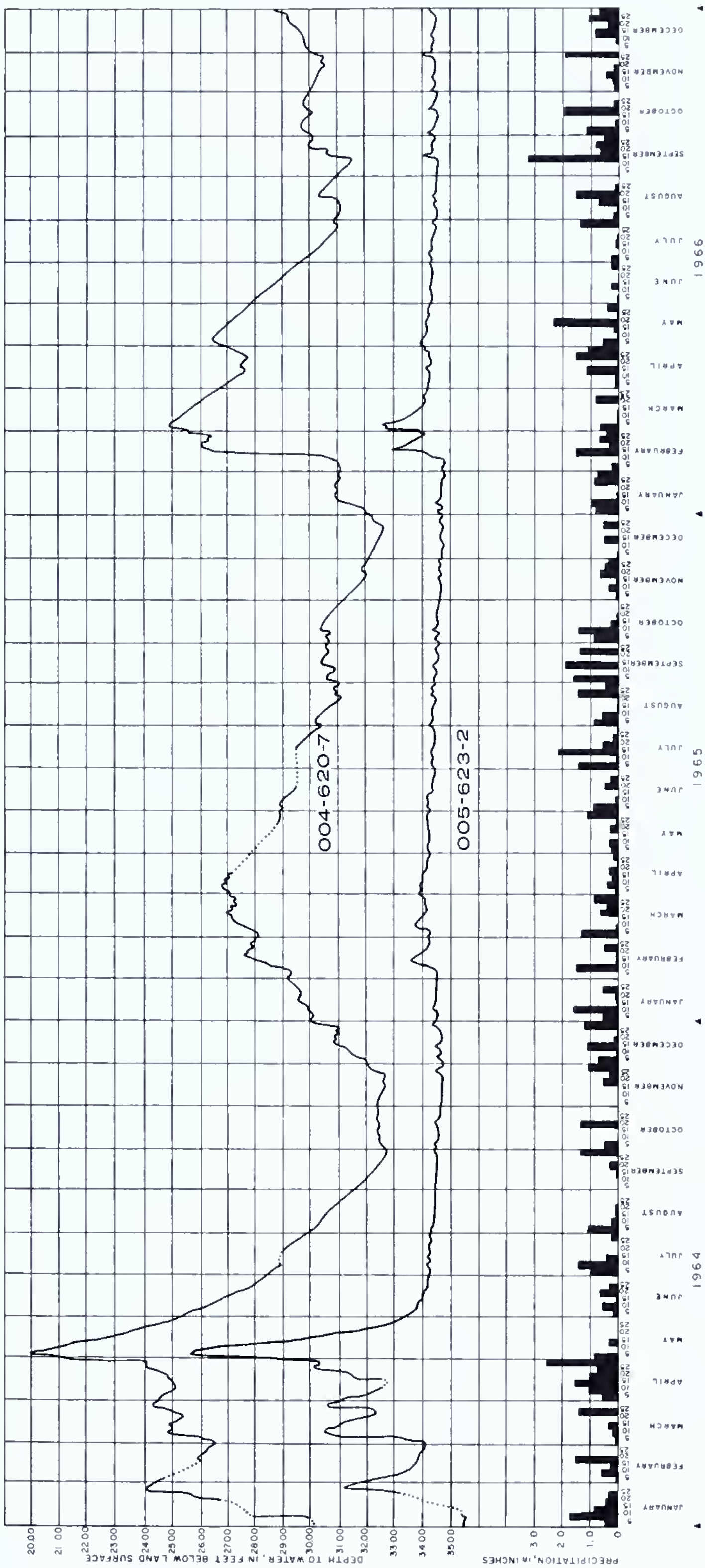


Figure 16. Hydrographs of wells 004-620-7 and 005-623-2 and precipitation at Lancaster.

fall or snowmelt) and decline when discharge exceeds recharge (during periods between rainfall).

Continuous water-level measurements have been recorded for four wells in the Lancaster quadrangle for a period of approximately 3 years. Hydrographs of two of these wells (004–620–7 and 005–623–2) and precipitation at Lancaster, Pa. are shown on Figure 16. The hydrograph of well 004–620–7 clearly shows water-level fluctuations from season to season. Water levels in this well rise through the winter months, reaching a peak in the spring, then decline through the growing season to a low in the fall.

Seasonal water-level fluctuations are caused by changes in recharge. In the growing season, recharge rates are reduced substantially by transpiration from vegetation. In the winter, most vegetation is dormant and recharge rates increase. The exact month during which the lowest and highest water levels are attained differs from year to year depending upon the amount, type, and distribution of precipitation relative to other factors, such as periods of frozen ground and the dates on which the growing season begins and ends. For example, the peak water level in well 004–620–7 was attained later (early May) in spring of 1964 than in 1965 and 1966 because of exceptionally heavy rainfall throughout April and the early part of May 1964. Abundant rainfall in April and May 1966 caused a May 1966 peak in the water level in this well, but this peak was lower than the March 1966 peak. The hydrograph for well 005–623–2 does not show seasonal water-level variations as sharply as well 004–620–7, but water levels are higher in the winter and early spring than in summer.

Long-term water-level trends can be correlated with long-term climatic cycles. Water levels are generally higher during periods of above-normal precipitation and lower during periods of below-normal precipitation. The record of water levels in the Lancaster quadrangle is too short to indicate any long-term trend.

The effect of individual rainfalls on ground-water levels is shown by the hydrograph of wells 004–620–7 and 005–623–2 (Figure 16). In well 005–623–2, small rises in water level accompany almost every period of rainfall, and the response of water levels in the well to three individual rainfalls is clearly shown in the large scale hydrograph in Figure 17.

Figure 17 shows also small semidiurnal water-level fluctuations attributed to earth tides produced by the attraction exerted on the earth's crust by the moon and, to a lesser extent, the sun. The two daily cycles of fluctuations occur about 50 minutes later each day and the water-level troughs coincide with the transit of the moon at upper and lower culmination (Richardson, 1956, p. 461 and Todd, 1959, p. 168).

GROUND WATER USE

The total amount of ground water that was used from carbonate rocks of

the Lancaster quadrangle in 1965 is estimated to be between 1.2 and 1.3 billion gallons. Public supply systems used approximately 500 million gallons and industry used approximately 310 million gallons in 1965, according to a compilation of data obtained from the Bureau of Statistics, Pennsylvania Department of Internal Affairs. Increased use of ground water in recent years is shown by the fact that public supply systems used only 350 million gallons in 1961. The remaining 400 to 500 million gallons of the total ground water used is an estimate of pumpage from residence and farm wells in the quadrangle. This estimate is based on a population of 11,500 people in the Lancaster quadrangle who do not live within a public supply system service area and a per capita water requirement of 75 gallons per day (U.S. Department of Health, Education, and Welfare, 1962, pub. no. 24, Table 1). The population estimate was derived from 1960 U.S. Bureau of Census statistics for civil divisions of Lancaster County. The residence and farm well pumpage calculation also includes about 100 million gallons estimated for watering livestock.

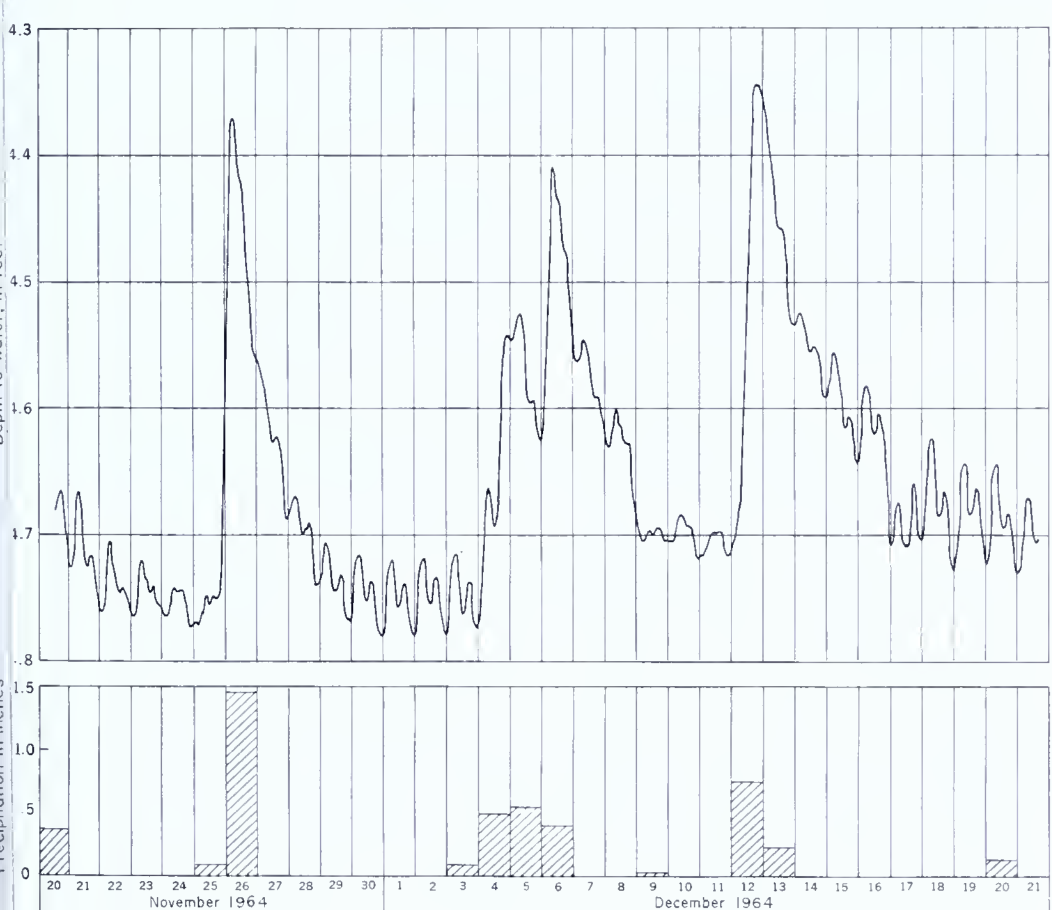


Figure 17. Hydrograph of well 005-623-2 and precipitation at Landisville, Pa.

QUALITY OF WATER

Dissolved mineral matter in ground water is derived from soluble mineral matter in the atmosphere, soil, and rocks through which the water moves. However, the chemical quality of ground water is governed chiefly by the nature of the soil and rock through which the water passes and by the length of time the water has been in contact with these materials. In addition, human activities such as the discharge of sewage, the use of fertilizers and insecticides, and the burial of refuse in sanitary landfills may greatly affect the type and amount of dissolved mineral matter in ground water.

The evaluation of the quality of water in the carbonate rocks of the Lancaster quadrangle is based upon the 70 chemical analyses from 53 wells and springs listed in Table 11.

Ground water in the carbonate rocks of the Lancaster quadrangle is of the calcium bicarbonate type. The major cations in the water in order of abundance are: calcium (Ca), magnesium (Mg), sodium (Na), and potassium (K). The major anions in order of abundance are: bicarbonate (HCO_3), sulfate (SO_4), nitrate (NO_3), chloride (Cl), and fluoride (F).

The median, 10-percentile, and 90-percentile concentrations of each of these constituents and of other constituents and properties of the ground water are given in Table 7.

Ground water in the Conestoga Formation is generally higher in silica,

Table 7. *Summary of chemical quality of ground water*

Constituent or property	Concentration in ppm, except for pH[1]		
	10 percentile[2]	Median	90 percentile[3]
Iron (Fe)	0.00	0.05	0.23
Calcium (Ca)	59	85	128
Magnesium (Mg)	11	21	40
Sodium (Na)	3.8	7.0	27
Potassium (K)	1.5	2.4	15
Bicarbonate (HCO_3)	191	269	376
Sulfate (SO_4)	16	40	89
Chloride (Cl)	9.2	17	62
Fluoride (F)	.0	.0	.2
Nitrate (NO_3)	9.8	38	95
Dissolved solids	288	390	586
Total hardness (as $CaCO_3$)	244	300	430
pH	7.14	7.46	7.68

[1] Based on 53 samples (one sample from each well or spring) except dissolved solids, which is based on 50 samples.

[2] Ten percent of samples have concentrations equal to or less than the value shown.

[3] Ninety percent of samples have concentrations equal to or less than the value shown.

calcium, sodium, sulfate, chloride, nitrate, and dissolved solids than is the water in the other carbonate rocks—as shown in the following table.

Constituent	Median concentration in ppm	
	Conestoga Formation[1]	All carbonate rocks excluding Conestoga Formation[2]
Silica (SiO_2)	11.5	7.7
Calcium (Ca)	118	75
Sodium (Na)	15	4
Sulfate (SO_4)	77	27
Chloride (Cl)	28	13
Nitrate (NO_3)	61	30
Dissolved solids	495	352

[1] Based on 14 samples
[2] Based on 39 samples

For the most part, these higher concentrations result from contamination in the area near Lancaster and Millersville. However, the higher concentration of silica may represent leaching of siliceous metamorphic minerals that are widespread in the Conestoga Formation. An abundance of disseminated pyrite (FeS_2) crystals throughout the Conestoga Formation may account in part for the higher sulfate content of ground water from this formation.

CHEMICAL CONTAMINATION

Some chemical constituents in ground water from the carbonate rocks of the Lancaster quadrangle occur in quantities large enough to indicate that some contamination is taking place as a result of waste disposal. A few constitutents are present in undesirably large quantities in the water from some wells and, thus, limit the usefulness of the water or require it to be treated.

Hardness, which is caused chiefly by calcium and magnesium ions in the water, is a result of the natural leaching of the carbonate rocks and need not be a result of waste disposal. Hardness of water forms scale in boilers, water heaters, and pipes, and consumes soap. Water from the carbonate rocks is very hard—only one well and one spring of the 53 wells and springs sampled yielded water having a hardness of less than 200 ppm.

The most widespread chemical contaminant in the carbonate rocks is nitrate. According to the U.S. Department of Health, Education, and Welfare (1962, Pub. no. 956, p. 48–50), water containing more than 45 ppm nitrate is potentially dangerous when used in infant feeding. Infant methemoglobinemia, a disease characterized by certain blood changes and cyanosis, may be caused by the high nitrate concentrations in the water. Twenty-

one of the 53 sampled wells and springs yielded water containing more than 45 ppm nitrate. Most of the nitrate probably is derived from nitrogen-rich fertilizers, nearby cesspools and septic tanks, or barnyard wastes.

Sodium and chloride are generally found in low concentrations in ground water from the carbonate rocks (Table 11), although several wells contain sufficient quantities of these constituents to indicate some contamination—possibly from waste water from water-softening systems or from fertilizers. However, even the highest concentration of these constituents (44 ppm sodium and 114 ppm chloride in well 004–624–3) is considerably below the maximum standards set for most water uses. The maximum recommended

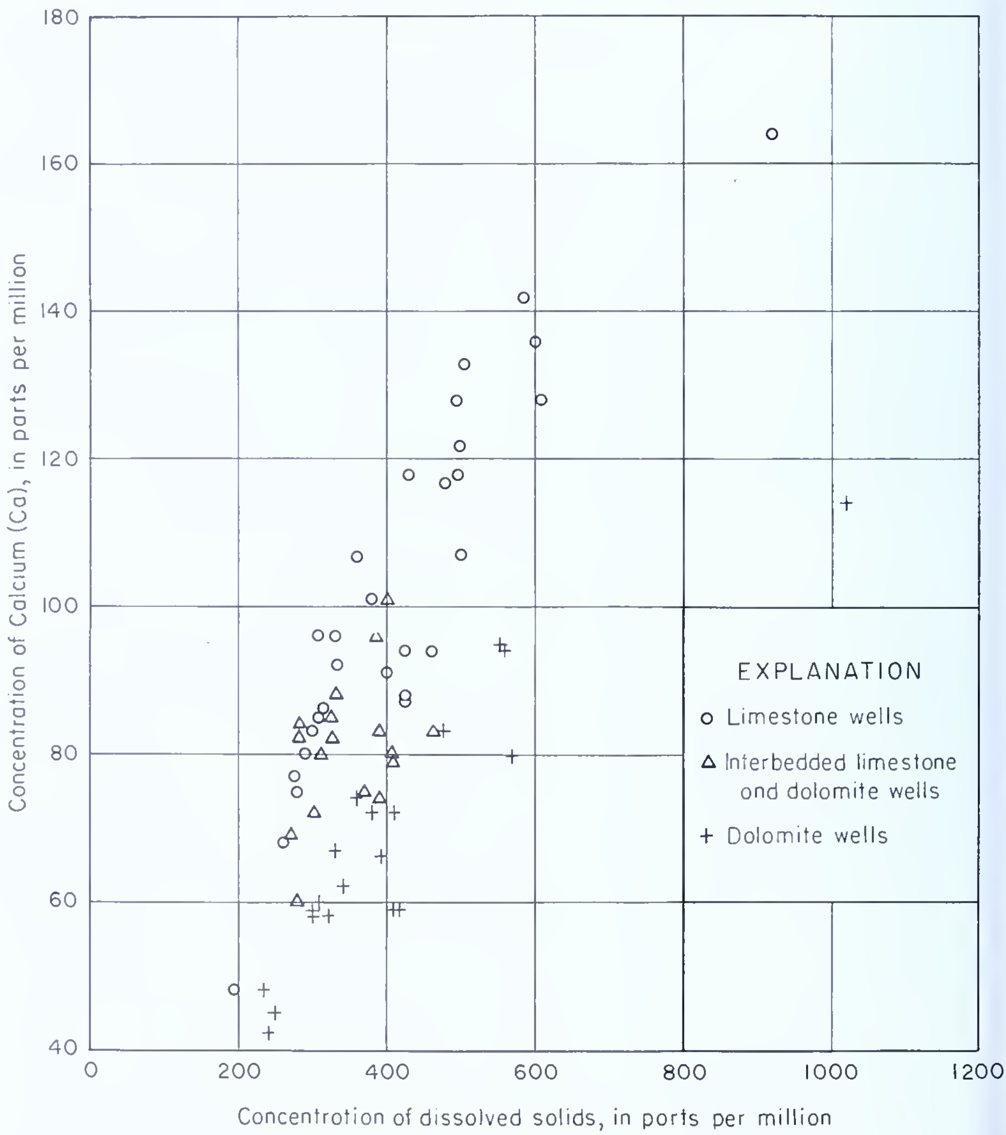


Figure 18. Graph showing relation of calcium content to dissolved-solids content.

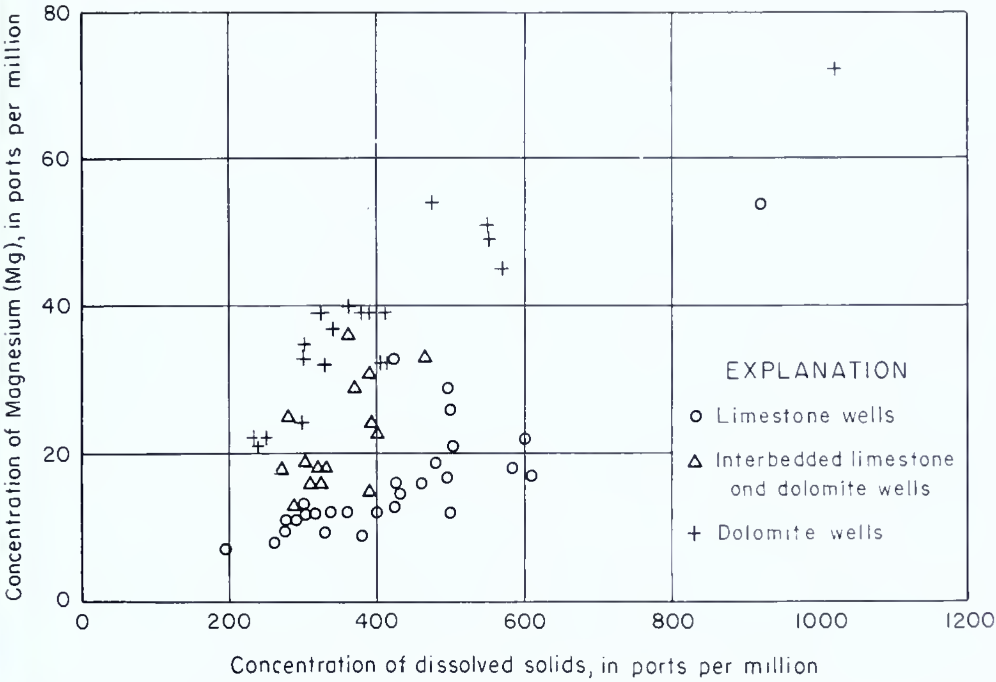


Figure 19. Graph showing relation of magnesium content to dissolved-solids content.

chloride content for drinking water set by the U.S. Department of Health, Education, and Welfare (1962, Pub. no. 956, p. 7) is 250 ppm. Hence, although some sodium and chloride contamination has taken place, it has not caused serious deterioration of water quality.

Iron in excessive amounts stains laundry a reddish brown color and imparts objectionable taste to water. The maximum iron content of drinking water recommended by the U.S. Department of Health, Education, and Welfare (1962, Pub. no. 956, p. 43) is 0.3 ppm. The iron concentration exceeded 0.3 ppm in water from five wells sampled in October 1963. Four of these five wells were sampled at a later date and the iron content was found to be below 0.3 in all four wells. The high iron concentrations found in 1963 were probably due to inadequate filtering of suspended iron particles from the samples. Iron contamination does not appear to be a problem in the carbonate rocks of the Lancaster quadrangle.

RELATION OF CONSTITUENTS TO DISSOLVED SOLIDS

The concentrations of several constituents are directly related to the dissolved-solids content. Both calcium content and magnesium content increase as the dissolved-solids content increases. (Figures 18 and 19). The graphs show higher concentrations of magnesium in water from wells in dolomite than in water from wells in limestone and higher concentrations of calcium in water from wells in limestone than in water from wells in dolomite.

Both sodium (Figure 20) and potassium content of the water increase as the dissolved-solids content increases. However, the sodium content does not increase gradually as dissolved-solids content increases; it increases abruptly above a dissolved-solids content of 400 ppm.

Bicarbonate content (Figure 21), sulfate content, chloride content, and nitrate content increase as dissolved-solids content increases. Figure 18 shows that water from the Conestoga Formation contains considerably lower concentrations of bicarbonate than water from the other formations for a given dissolved-solids content. Percentage equivalents per million of both sulfate and chloride tend to increase, whereas percentage equivalents per million of bicarbonate (Figure 22) decrease as dissolved-solids content increase. Percentage equivalents per million of nitrate appears to be independent of dissolved-solids content.

Electrical conductance is the ability of a material to conduct an electric current. Specific conductance is the electrical conductance of a cube of the material one centimeter on a side. The presence of dissociated ions in water cause it to be conductive; hence, specific conductance generally increases as ionic concentrations increase. Specific conductance is expressed in micro-

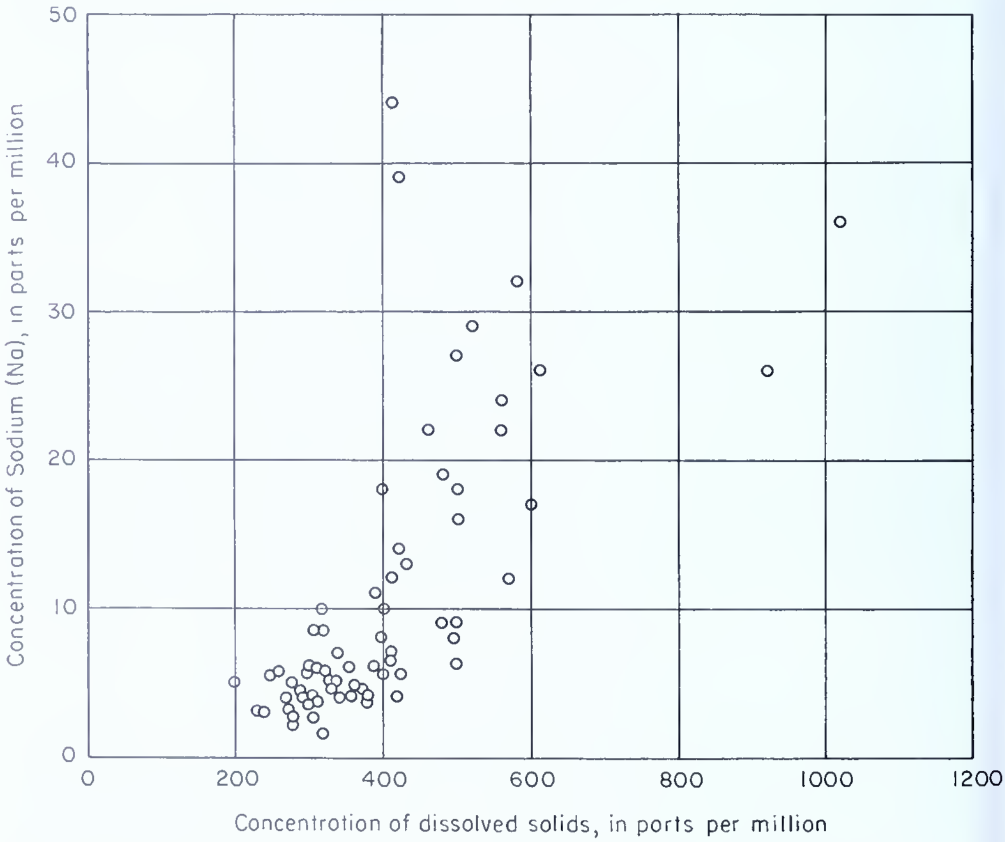


Figure 20. Graph showing relation of sodium content to dissolved-solids content.

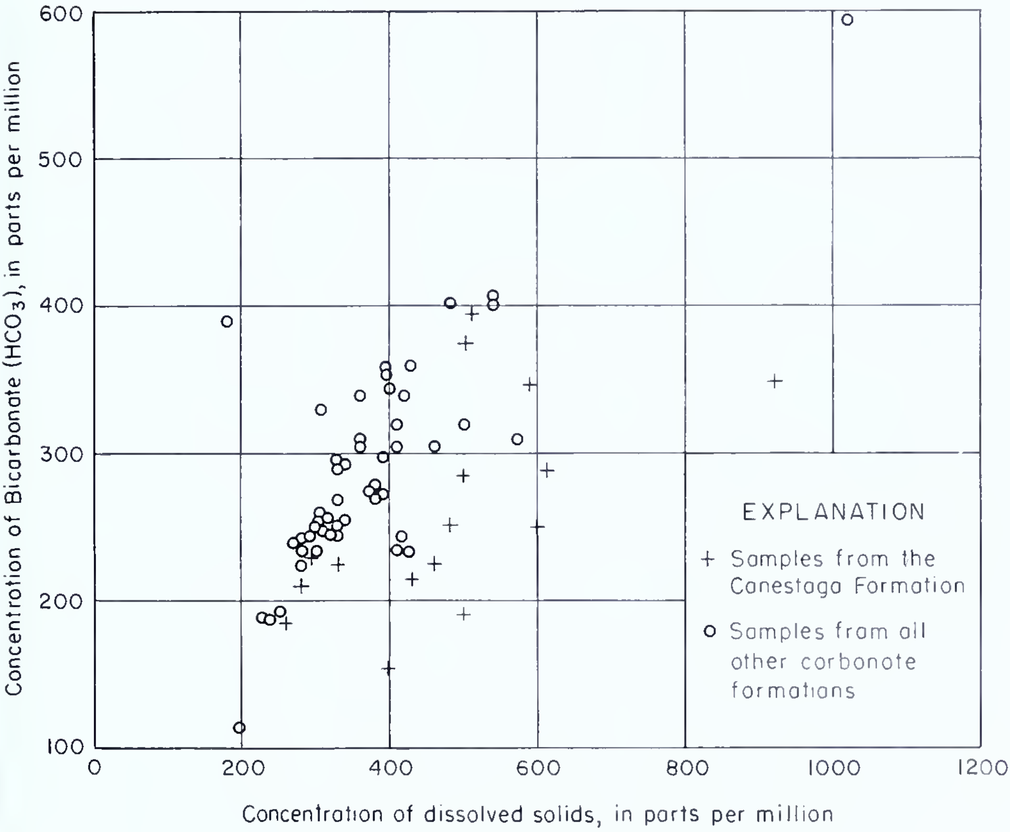


Figure 21. Graph showing relation of bicarbonate content to dissolved-solids content.

mhos per centimeter at 25°C. Field determinations of specific conductance were made on samples from approximately 460 wells. The relation between field determinations of specific conductance and dissolved-solids content, based on data from 61 sampled wells from which both field measurements of specific conductance and laboratory determination of dissolved solids are available, is shown in Figure 23. The line of regression shown on the graph was determined by the method of least squares. The coefficient of correlation is 0.95 (the coefficient of correlation is 1.00 for a perfect correlation), and the standard error of estimate is 63 micromhos. The standard error of estimate is the average (quadratic mean) of the deviations about the line of regression. Because of the close correlation, Figure 23 can be used to convert the 460 field determinations of specific conductance shown in Table 9 to dissolved-solids content.

The aerial distribution of field determinations of conductance of ground water is shown in Figure 24. Most of the Lancaster quadrangle contains ground water having specific conductances between 400 and 700 micromhos per centimeter. However, wells containing waters having specific conductances greater than 700 micromhos are widely scattered through most of the

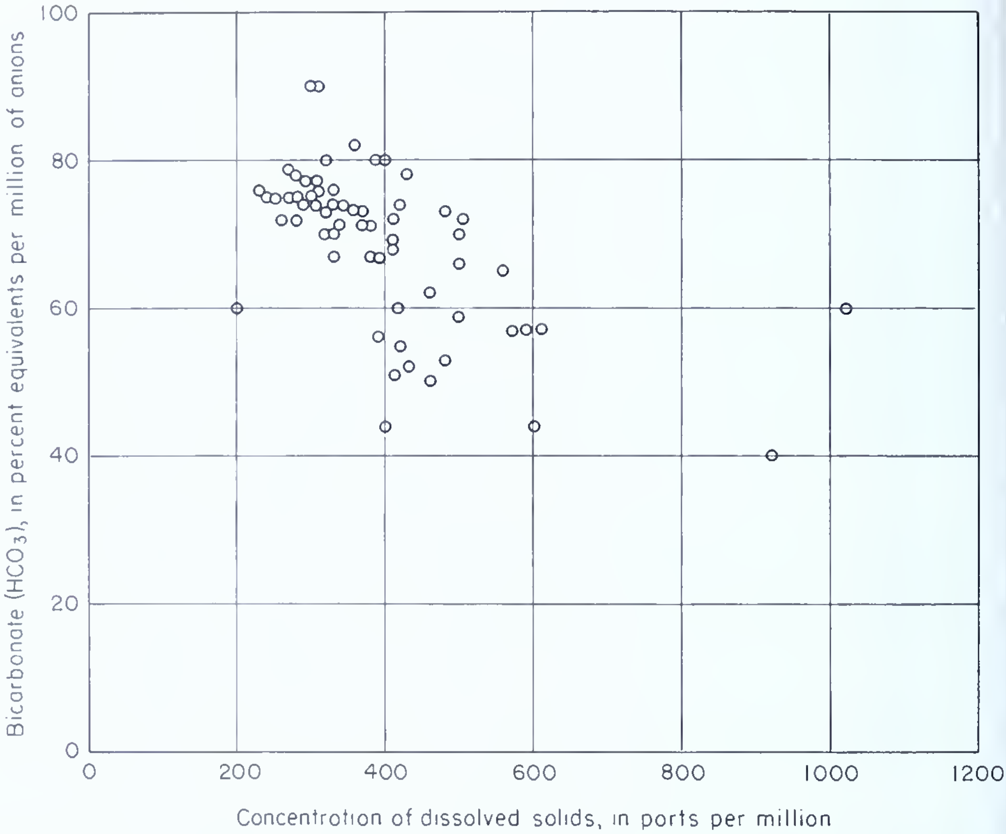


Figure 22. Graph showing relation of percent equivalents per million of bicarbonate to dissolved-solids content.

Lancaster quadrangle. In most of these wells, the higher specific conductance is the result of local contamination—such as nearby septic tank or barnyard effluent. Large areas having more highly conductive water are evident in the vicinity of Lancaster, Millersville, and south and east of Mount Joy. There are areas in the southwestern part of the quadrangle where the specific conductance of the ground water is less than 400 micromhos. Low specific conductance probably results from the inflow of ground water of low mineralization from adjacent ridges underlain by quartzite of Cambrian age.

HYDROGEOLOGIC SIGNIFICANCE OF CALCIUM-MAGNESIUM RATIOS

The ratios, in equivalents, of calcium to magnesium in ground water from the limestones and dolomites of the Lancaster quadrangle correlate well with the composition of the carbonate source rocks.

Cumulative-frequency-distribution plots of the ratios of calcium to magnesium (equivalents per million) in ground water from five stratigraphic units are shown in Figure 25. The lowest calcium-magnesium ratios occur in

the dolomite units, the highest ratios occur in the limestone units, and intermediate ratios occur in interbedded limestone and dolomite.

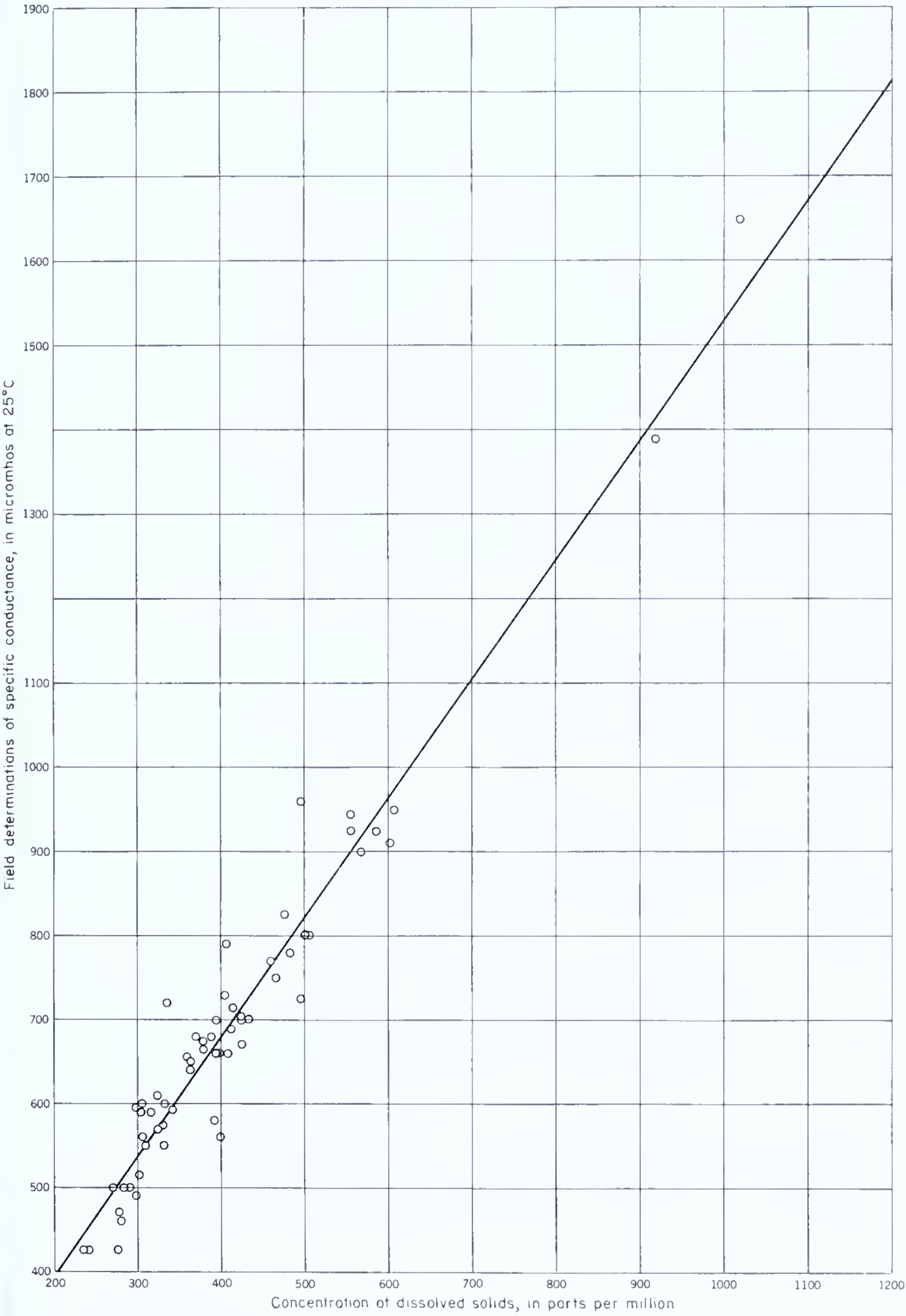


Figure 23. Graph showing relation of specific conductance to dissolved-solids.

The dolomite units (Ledger and Vintage Formations and Zooks Corner Formation) plot as a single straight line, indicating that they are normally distributed and have been drawn from a single population. The flat slope of the line indicates the small variability of the data. The mean calcium-magnesium ratio is 1.09 and the standard deviation is 0.10.

Calcium-magnesium ratios in ground water from dolomite are very close to the stoichiometric proportion (1 to 1) of calcium to magnesium in the

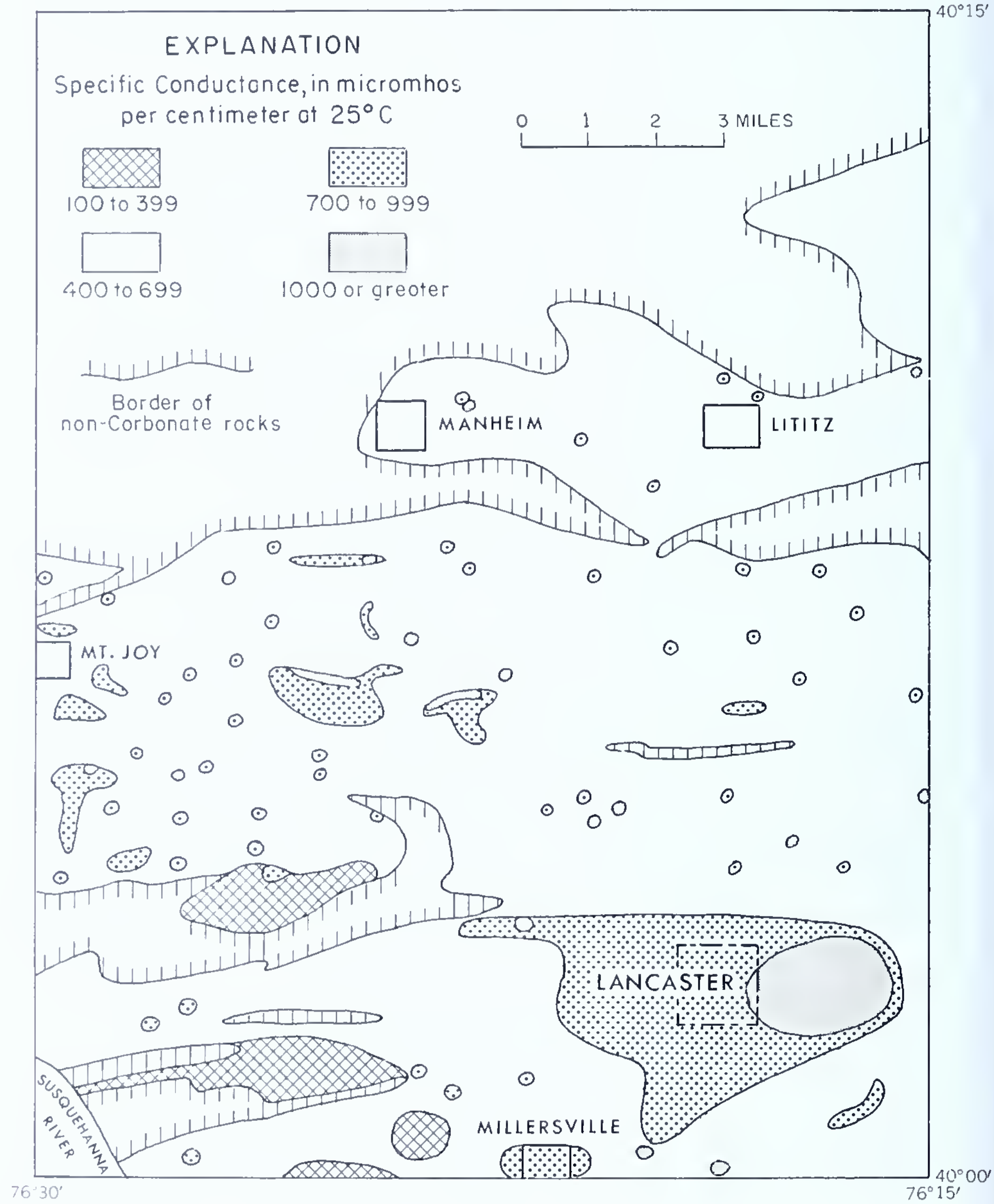


Figure 24. Generalized map showing specific conductance of ground water in the carbonate rocks of the Lancaster quadrangle.

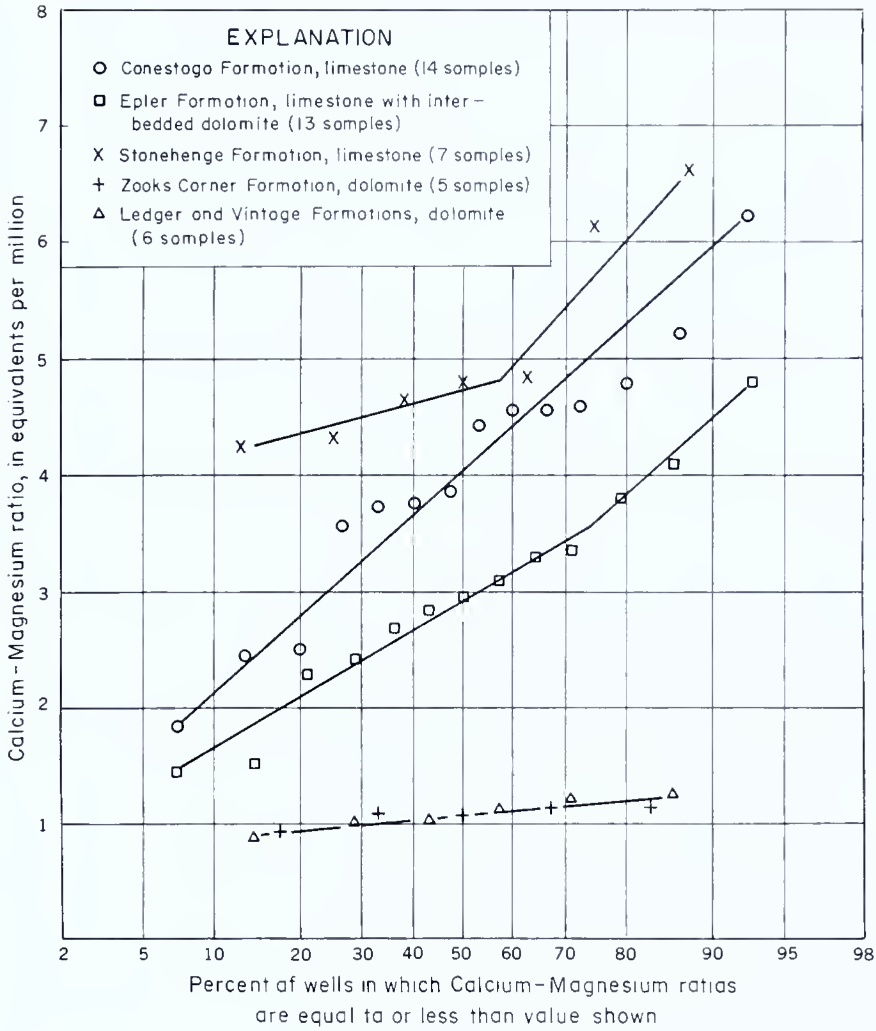


Figure 25. **Graph showing the cumulative frequency distribution of calcium-magnesium ratios in ground water from wells grouped according to stratigraphic unit.**

mineral dolomite. Thus, the scarcity of calcite observed in geologic mapping is corroborated by the chemistry of the ground water.

Calcium-magnesium ratios of water from the limestones are much higher, more variable, and less normally distributed than those from the dolomites. In ground water from the Conestoga Formation, the mean calcium-magnesium ratio is 4.00 and the standard deviation is 1.13. In the Stonehenge Formation, the mean calcium-magnesium ratio is 5.09 and the standard deviation is 0.85.

The relatively large variation of calcium-magnesium ratios in ground water from the limestone wells may have more than one explanation, though

variability in the magnesium content of the carbonate rocks is probably the principal reason. Also, the magnesium content of shale laminae, which are locally abundant, may affect the calcium-magnesium ratio. Magnesium enrichment may occur also in ground water that has traveled long distances or has been in contact with rock for relatively long periods of time; thus, it has reached equilibrium with respect to the more soluble calcite but not with respect to the less soluble dolomite. In such waters, the minor amounts of dolomite present in the rocks may continue to be dissolved while no calcite is being dissolved.

Calcium-magnesium ratios of ground water from the interbedded limestone and dolomite of the Epler Formation are intermediate between the ratios of limestone waters and the ratios of dolomite waters. The distribution of calcium-magnesium ratios plot very nearly on a straight line, indicating a normal distribution. The mean calcium-magnesium ratio is 2.98 and the standard deviation is 0.91.

The ratios of calcium to magnesium proved useful in corroborating the position of stratigraphic contacts in a few places where outcrops were scarce.

CONCLUSIONS

Carbonate rocks of Cambrian and Ordovician age in the Lancaster quadrangle form one complex, heterogeneous, water-table aquifer. Ground water in the carbonate rock occurs in bedding and cleavage planes, joints, faults, and other fractures. The number and size of the openings and the degree of interconnection between them determine the ability of the carbonate rocks to store and transmit water. Where these openings have been enlarged by solution, large amounts of water may be available to wells.

The carbonate strata are divided into 14 units defined primarily by their relative proportions of limestone and dolomite. The capability of 10 of the stratigraphic units to supply water to wells for several defined general use categories is summarized in Table 8.

Specific capacity appears to be related to lithology. In general, limestone units have higher specific capacities than dolomite or interbedded limestone and dolomite units. Also, units containing a relatively low noncarbonate clay, silt, and sand content have higher specific capacities than units containing a relatively high noncarbonate content.

Specific capacities of wells in the carbonate rocks appear to be related to topography. The most favorable topographic position for a well is in a valley and the least favorable position is on a ridge.

Shallow wells generally have higher specific capacities than deep wells. For wells that fail to obtain water in sufficient amounts at moderate depths (less than 200 feet), deepening the well is less likely to provide the needed water than drilling a new well.

Table 8. *Summary of formation capability to supply water for different use categories*

Use	Evaluation of formation: Excellent (80–100)[a]	Very good (60–79)[a]	Good (40–59)[a]	Fair (20–39)[a]	Poor (0–19)[a]
Public supply and industrial (specific capacity—5.)[b]		Stonehenge		Vintage Kinzers Ledger Epler Conestoga	Zooks Corner Buffalo Springs Millbach Richland
Small public supply and some industrial (specific capacity—.5)[b]	Ledger Stonehenge	Conestoga	Vintage Kinzers Epler	Zooks Corner Buffalo Springs Millbach Richland	
Domestic (specific capacity —.08)[b]	Vintage Kinzers Ledger Stonehenge Conestoga	Zooks Corner Buffalo Springs Millbach Epler	Richland		

[a] Percent of wells having specific capacities greater than the minimum considered sufficient for the stated use.

[b] Minimum specific capacity considered sufficient for the stated use.

The carbonate strata have been deformed into a complicated structural framework that is characterized by recumbent folding and imbricate thrust faulting in the north; general uplift, complex open folding, and intricate faulting near the center; and upright isoclinal folding and reverse faulting in the south. The general sequence of events producing this complex structural framework is interpreted as recumbent folding, overlapped or closely followed by thrust faulting, and later refolding or warping of existing structures by basement adjustments. No relationship could be found between structure and the specific capacities of wells.

The average specific yield of the zone of water-table fluctuations in the carbonate rocks of the Little Conestoga Creek basin above the Conestoga Country Club is approximately 0.04.

Ground water in the carbonate rocks is of the calcium-bicarbonate type. The water is very hard—only 1 well and 1 spring of the 53 wells and springs sampled have hardnesses of less than 200 ppm. Nitrate contamination is common, as 21 of the 53 wells and springs sampled contain more than 45 ppm nitrate, the maximum considered acceptable in drinking water by the U.S. Department of Health, Education, and Welfare. Specific conductance

of ground water in the carbonate rocks is generally between 400 and 700 micromhos. Waters having specific conductance greater than 700 micromhos are generally contaminated. Such waters are scattered widely through the Lancaster quadrangle but are most common in the vicinity of Lancaster, Millersville, and south and east of Mount Joy.

Calcium-magnesium ratios in ground water correlate well with the composition of the carbonate source rocks. The lowest ratios occur in water from dolomite units, the highest ratios occur in water from limestone units, and intermediate ratios occur in water from interbedded limestone and dolomite. Calcium-magnesium ratios were helpful in confirming the location of geologic contacts in the Lancaster quadrangle.

REFERENCES

Freedman, J., Wise, D. U., and Bentley, R. D. (1964), *Pattern of folded folds in the Appalachian Piedmont along Susquehanna River*, Geol. Soc. America Bull., v. 75, p. 621–638.

Geyer, A. R., and others (1963), *Geology and mineral resources of the Womelsdorf quadrangle, Pennsylvania*, Pa. Geol. Survey, 4th ser. Geol. Atlas 177-c, 81 p.

——— (1968), *Geology of the Lebanon quadrangle, Pennsylvania*, Pa. Geol. Survey, 4th ser., Geol. Atlas 167-c.

Gray, Carlyle (1952), *The nature of the base of the Martinsburg Formation*, Pa. Acad. of Sci. Proc., v. 26, p. 86–92.

———, and others (1958), *Geology of the Richland quadrangle, Pennsylvania*, Pa. Geol. Survey, 4th ser., Geol. Atlas 167-d.

———, Shepps, V. C., and others (1960), *Geologic map of Pennsylvania*, Pa. Geol. Survey, 4th ser.

Hall, G. M. (1934), *Ground water in southeastern Pennsylvania*, Pa. Geol. Survey, 4th ser., Bull. W-3, 255 p.

Hobson, J. P., Jr. (1957), *Lower Ordovician (Beekmantown) succession in Berks County, Pennsylvania*, Am. Assoc. Petroleum Geologists Bull., v. 41, p. 2710–2722.

——— (1963), *Stratigraphy of the Beekmantown Group in southeastern Pennsylvania*, Pa. Geol. Survey, 4th ser., Gen. Geol. Rept. G-37, 331 p.

Jonas, A. I., and Stose, G. W. (1926), *Geology and mineral resources of the New Holland quadrangle, Pennsylvania*, Pa. Geol. Survey, 4th ser. Geol. Atlas 178, 40 p.

——— (1930), *Geology and mineral resources of the Lancaster quadrangle, Pennsylvania*, Pa. Geol. Survey, 4th ser., Geol. Atlas 168, 103 p.

——— (1936), *Age reclassification of the Frederick Valley (Maryland) limestones*, Geol. Soc. America Bull., v. 47, p. 1657–1674.

Kauffman, N. M. (1960), *Climates of the states, Pennsylvania*, U.S. Dept. of Commerce, Weather Bur., 20 p.

Knopf, E. B., and Jonas, A. I. (1929), *Geology of the McCalls Ferry-Quarryville district, Pennsylvania*, U.S. Geol. Survey Bull. 799, 156 p.

Meisler, Harold (1963), *Hydrogeology of the carbonate rocks of the Lebanon Valley, Pennsylvania*, Pa. Geol. Survey, 4th ser., Bull. W-18, 81 p.

———, and Becher, A. E. (1966), *Hydrology of the carbonate rocks of the Lancaster 15-minute quadrangle, Pennsylvania*, Pa. Geol. Survey, 4th ser., Prog. Rept. 171, 36 p.

——— (1968), *Carbonate rocks of Cambrian and Ordovician age in the Lancaster quadrangle, Pennsylvania*, U.S. Geol. Survey Bull. 1254-G, 14 p.

Olmsted, F. H., and Hely, A. G. (1962), *Relation between ground water and surface water, Brandywine Creek basin, Pennsylvania*, U.S. Geol. Survey Prof. Paper 417-A, 21 p.

Prouty, C. E. (1959), *The Annville, Myerstown, and Hershey Formations of Pennsylvania*, Pa. Geol. Survey, 4th ser., Bull. G-31, 47 p.

Richardson, R. M. (1956), *Tidal fluctuations of water level observed in wells east Tennessee*, Am. Geophys. Union Trans., v. 37, p. 461–462.

Root, S. I. (1967), *Geology and mineral resources of the southern half of the Chambersburg quadrangle, Pennsylvania*, Pa. Geol. Survey, 4th ser., Geol. Atlas 119-c and d.

Stose, G. W., and Jonas, A. I. (1922), *The Lower Paleozoic section of southeastern Pennsylvania*, Washington Acad. Sci. Jour., v. 12, p. 358–366.

——— (1933), *Geology and mineral resources of the Middletown quadrangle, Pennsylvania*, U.S. Geol. Survey Bull. 840, 86 p.

Stose, A. I. J., and Stose, G. W. (1944), *Geology of the Hanover-York district, Pennsylvania*, U.S. Geol. Survey Prof. Paper 204, 84 p.

Todd, D. K. (1959), *Ground water hydrology*, New York, John Wiley and sons, 336 p.

U.S. Department of Health, Education, and Welfare, Public Health Service (1962), *Drinking water standards*, Pub. no. 956, 61 p.

——— (1962), *Manual of individual water supply systems*, Pub. no. 24, 121 p.

Walcott, C. D. (1896), *Cambrian rocks of Pennsylvania*, U.S. Geol. Survey Bull., 134, 43 p.

Wilson, J. L. (1952), *Upper Cambrian stratigraphy in the central Appalachians*, Geol. Soc. America Bull., v. 63, p. 275–322.

APPENDIX

MEASURED REFERENCE SECTIONS

Section 1

Section located along the Susquehanna River 0.3 miles south of the southern boundary of Columbia, Pa., or at approximately 40°01′05″ N latitude and 76°29′20″ W longitude.

(Measured by H. Meisler and A. Becher)

Cambrian

Vintage Formation

	Feet
Dolomite, medium-gray and medium-dark-gray, finely crystalline, sparkling; weathers light gray to yellowish gray; little medium-light-gray dolomite; some very finely crystalline dolomite; parting into 4-inch to 2-foot layers and massive; few fine wavy siliceous laminae.	67
Dolomite, medium-light-gray to medium-gray, very finely to finely crystalline; weathers light gray to yellowish gray; massive; fine wavy siliceous laminae.	11
Shale, medium-gray to medium-dark-gray; contains some medium-dark-gray dolomite.	1½
Dolomite, medium-light-gray to medium-gray, very finely crystalline; weathers light gray to yellowish gray; parting into ½- to 2-foot layers; fine wavy siliceous laminae in upper 9½ feet.	13
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers light gray to medium-light-gray; parting into 2- to 5-inch layers; contains yellowish gray shale beds up to 2 inches thick.	2

	Feet
Dolomite, medium-light-gray to medium-gray, very finely and finely crystalline; weathers light gray; massive.	12
Covered.	4
Dolomite, medium-light-gray to medium-dark-gray, very finely and finely crystalline; weathers light gray; parting into ½- to 5-foot layers; some fine siliceous laminae.	39
Covered.	15–20
Dolomite, medium-light-gray to medium-dark-gray, very finely to finely crystalline, sparkling; weathers light gray to medium-light-gray; massive.	18
Dolomite, medium-gray, very finely crystalline; weathers light gray; parting into 5- to 12-inch layers; some wavy siliceous and argillaceous laminae; has a "knotty" or "lumpy" appearance on weathered surfaces.	8
Dolomite, medium-gray, very finely crystalline; weathers medium-light-gray to medium-gray; mostly argillaceous; several shaly beds; has a "knotty" or "lumpy" appearance on weathered surfaces.	15
Dolomite, medium-gray to medium-dark-gray, very finely to finely crystalline; weathers medium-light-gray; argillaceous in part.	25
Dolomite, medium-gray, very finely crystalline; weathers medium-light gray to light olive gray; parting into 4- to 12-inch layers; argillaceous in part; few shaly beds; has a "lumpy" appearance on weathered surfaces.	11
Covered.	4
Dolomite, medium-gray and medium-dark-gray, very finely to finely crystalline; weathers medium dark gray to yellowish gray; parting into 2- to 12-inch layers; irregular and wavy laminae; argillaceous in part; has a "knotty" or "lumpy" appearance on weathered surfaces.	8
Dolomite, argillaceous, light-gray, very finely crystalline; weathers yellowish gray to light olive gray; parting into 1- to 18-inch layers; abundant interbeds of very-pale-orange shale; has a "lumpy" appearance on some weathered surfaces.	16
Dolomite, medium-light-gray to medium-gray, very finely crystalline; weathers yellowish gray to light olive gray; parting into 8-inch to 3-foot layers; faintly laminated in part; argillaceous in part; has a "lumpy" appearance on some weathered surfaces.	26
Total	216–221
Antietam Quartzite	unmeasured

Section 2

Section along the Pennsylvania Railroad 1.1 to 1.4 miles NNW of northwest corner of boundary of the city of Lancaster, Pa., or approximately at 40°04′ N latitude and 76°20′ W longitude.

(Measured by A. Becher and H. Meisler)

Lower Cambrian

Ledger Formation

Dolomite, very-light-gray to light-gray, medium and coarsely crystalline, sparkling; massive; abundant discontinuous exposures extend-

	Feet
ing approximately 1,000 feet NW of described units; thickness unknown because of lack of visible bedding.	—
Dolomite, light-gray and medium-light-gray, finely crystalline, sparkling; weathers very pale orange.	8
Covered interval containing isolated shattered outcrops of dolomite.	15–20
Dolomite, medium-light-gray to medium-gray and light-gray, finely to medium crystalline; weathers very pale orange.	10
Dolomite, light-gray to medium-light-gray, finely to medium crystalline; weathers very pale orange; parting into ½- to 1½-foot layers; bedding N 50° E, 13° N.	5½
Covered.	0–2
Dolomite, very-light-gray to grayish yellow, finely to medium crystalline, sparkling; some mottling; weathers very pale orange; parting into 1- to 2-foot layers; bedding N 80° W, 7° N.	7
Dolomite, oolitic, light-gray, some very-light-gray, finely to medium crystalline, sparkling; some mottling; weathers yellowish gray; parting into 1½- to 4-foot layers; faint laminae marked by darker color and by changes in size or density of oolites.	10
Dolomite, very-light-gray, some light-gray and medium-light-gray, finely to medium crystalline, sparkling; some mottling; weathers very pale orange; parting into ½- to 2-foot layers.	8
Dolomite, very-light-gray and light-gray, finely crystalline, sparkling; some cryptocrystalline; weathers very pale orange.	7
Dolomite, very-light-gray, very finely crystalline, sparkling; weathers very pale orange; a ½-foot light gray weathering laminated zone located 5½ feet from base.	8
Covered.	10–15
Dolomite, light-gray to yellowish gray, finely to medium crystalline, sparkling; little mottling; weathers very pale orange; shattered appearance.	5
Dolomite, light-gray, finely crystalline, sparkling; medium-gray dolomite in top 1 foot; weathers very pale orange; parting into 1½- to 2-foot layers; faint laminae; oolites in upper 2 feet.	4½
Dolomite, very-light-gray and light-gray, finely and medium crystalline, sparkling; mottled in part; weathers very pale orange; parting into 1- to 1½-foot layers at top and base; two prominent intersecting cleavages.	10
Traverse 80 feet along strike (S 85° E) to east side of railroad tracks.	
Dolomite, light-gray, very finely and finely crystalline, sparkling; mottled; weathers yellowish gray to light gray; parting into 3-inch to 3-foot layers; bedding N 85° W, 12° N.	13½
Probable fault, displacement unknown.	—
Dolomite, yellowish-gray, very finely crystalline; weathers yellowish gray; parting into 1- to 2-foot layers; few faint laminae, few quartz blebs and stringers.	3½
Dolomite, light-gray, very finely to finely crystalline, sparkling; medium-gray mottling; weathers very pale orange; massive.	3
Dolomite fault breccia, very-light-gray to medium-gray, very finely to finely crystalline; ¼- to 2-inch blocks; weathers very pale orange; vertical mass three feet wide.	—
Dolomite, medium-gray, very finely to finely crystalline, sparkling; weathers medium light gray to yellowish gray; parting into 3-foot	

	Feet
layers; some indistinct discontinuous laminae, a 4-inch zone of oolites elongated perpendicular to bedding; bedding N 85° W, 8° N.	6
Covered.	5
Dolomite, light-gray, medium-light-gray, and medium-gray, finely to medium crystalline, sparkling; weathers very pale orange to medium light gray; massive; irregular chert masses several inches in diameter.	3
Total	142–154

Section 3

Section located along Conestoga Creek from 0.6 mile SW of Zooks Corner to 0.7 mile WNW of Zooks Corner or from approximately 40°04′25″ N latitude and 76°15′45″ W longitude northward along Conestoga Creek to 40°05′ N latitude and 76°16′ W longitude.

(Measured by H. Meisler and A. Becher)

Cambrian Buffalo Springs Formation	Feet
Dolomite, medium-gray, very finely crystalline; weathers grayish yellow; well laminated; regular and wavy, silty to sandy laminae up to ½-inch thick, that weather out into ribs.	4
Dolomite and limestone, interlaminated, medium-dark-gray, very finely crystalline; weathers medium light gray and yellowish gray to pale olive; laminae and thin beds up to 1-inch thick; some silty laminae; gradational from unit above.	2
Limestome, medium-gray, finely to medium crystalline; weathers medium to medium light gray; parting into 1- and 2-foot layers; medium grained sand size oolites in upper 1 foot.	3
Covered.	1
Dolomite, medium-gray and medium-dark-gray, very finely and finely crystalline; parting into 8-inch to 1-foot layers; well laminated; dark and light laminae on unweathered surfaces; calcareous dolomite and some limestone in upper 2 feet.	5
Covered.	1½
Limestone, medium-dark-gray, finely to medium crystalline.	1½
Limestone, medium-gray and medium-dark-gray, finely and medium crystalline; weathers medium light gray; massive.	4
Dolomite, medium-gray and medium-dark-gray, very finely and finely crystalline; parting into 1½- to 8-inch layers; distinct color laminae.	4½
Limestone, medium-gray and medium-dark-gray, finely and medium crystalline; some mottling; weathers medium light gray to medium gray; massive; some disseminated grains and small patches of dolomite.	8
Limestone, medium-gray, finely and medium crystalline; coarsely crystalline patches; weathers medium light gray; parting into 2- to 6-inch layers; fine color laminae and some silty laminae.	3½
Limestone, medium-gray and medium-dark-gray, finely and medium crystalline; little medium-light-gray limestone; weathers medium light gray; massive; few small dolomite patches.	6½
Covered.	4

	Feet
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers yellowish gray with medium dark gray laminae; well laminated; regular to wavy laminae up to 1-inch thick with some anastomosing disrupted laminae; medium-gray limestone laminae up to 1-inch thick in lower 4 feet and becoming more abundant near base.	8½
Covered.	5
Limestone, medium-gray and medium-dark-gray; finely and medium crystalline; weathers medium light gray; silty weathering laminae up to ¼-inch thick.	5
Limestone, very-light-gray to light-olive-gray and very-light-gray, medium and coarsely crystalline; indistinctly laminated in part; some grayish orange laminae.	4½
Limestone, medium-gray and light-olive-gray, finely and medium crystalline; weathers light gray to medium light gray with yellowish gray laminae; indistinct, irregular, silty laminae up to ¼-inch thick.	4½
Limestone, yellowish-gray to light-gray, very finely crystalline; weathers very pale orange; a 2-inch bed of very-light-gray finely to medium crystalline limestone located 2 feet above base; distinct fine color laminae; soft-sediment deformation in scattered zones but most abundant immediately above the 2-inch limestone bed.	5
Limestone, light-gray to medium-light-gray and light gray, medium and coarsely crystalline; some mottling; weathers light gray; indistinct bedding; indistinct grayish orange cleavage laminae.	13
Limestone, light-gray to light-olive-gray, very finely crystalline; distinct fine color laminae.	2½
Limestone, medium-light-gray, medium-gray, and very-light-gray, finely crystalline; weathers medium light gray and yellowish gray; parting into 4- to 8-inch layers; some deformed laminae.	3
Dolomite, medium-gray, very finely crystalline; weathers medium light gray; parting into 1½- to 3-inch layers.	1
Limestone, medium-gray and medium-dark-gray, finely and medium crystalline; weathers medium light gray; distorted siliceous laminae weathering into ribs.	4½
Covered.	2
Dolomite, medium-gray, very finely to finely crystalline; weathers yellowish gray; fine laminae on weathered surface.	1
Limestone, medium-gray, very finely and finely crystalline; weathers very light gray to pale orange; parting into 4-inch to 1-foot layers; finely laminated in part.	4
Dolomite, medium-gray, very finely crystalline; parting into 2- to 3-inch layers; few indistinct laminae.	1
Covered.	1
Limestone, light-gray, medium-gray, medium-dark-gray, very finely to finely crystalline and medium crystalline; parting into 4- to 8-inch indistinct layers; few thin siliceous and silty laminae.	3
Dolomite, medium-dark-gray, very finely crystalline, parting into 2- to 4-inch layers.	1
Covered.	1
Limestone, very-light-gray to very-pale-orange, finely to medium crystalline; pale yellowish-orange stringers.	½

	Feet
Limestone, medium-gray, finely crystalline; weathers light gray to medium light gray; massive.	3
Dolomite, medium-dark-gray, very finely and finely crystalline; parting into ½- to 1½-foot beds.	3½±
Limestone, medium-gray, finely crystalline; weathers light gray and very light gray; irregular silty laminae up to ¼-inch thick; distinctly laminated calcareous siltstone in upper 2 inches; abundant anastomosing siliceous laminae in bottom 3 inches.	4½
Total	130½±

Zooks Corner Formation	Feet
Dolomite, medium-dark-gray, very finely to finely crystalline; weathers yellowish gray to light olive gray; parting into indistinct 4-inch to 1-foot layers; siliceous laminae in top 1 foot and in zone 2½ to 3 feet below top.	4½
Dolomite, medium-dark-gray, very finely crystalline; weathers medium dark gray; parting into 1- to 2-inch layers; distinctly laminated; silty laminae.	1
Limestone, medium-dark-gray, finely crystalline.	1
Dolomite, medium-dark-gray, very finely crystalline; weathers very pale orange to yellowish gray; distinct fine laminae.	8
Dolomite, medium-gray, finely to medium crystalline; weathers yellowish gray; massive; abundant fine siliceous laminae near top becoming widely spaced downward.	3
Dolomite, medium-dark-gray, very finely crystalline; weathers light olive gray.	1½
Dolomite, medium-gray to light-olive-gray, finely to medium crystalline; weathers yellowish gray to pale olive; very granular weathered surface.	1
Dolomite, medium-gray, very finely crystalline; weathers yellowish gray to light olive gray; prominent siliceous laminae.	2½
Dolomite, medium-gray, finely crystalline; weathers yellowish gray; massive.	3
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish gray to pale olive; abundant silty laminae up to ¼-inch thick; fine laminae on weathered surface in bottom 6 inches.	2½
Dolomite, medium-light-gray and medium-gray, finely crystalline; weathers very light gray to yellowish gray; poorly bedded.	5
Dolomite, medium-light-gray to medium-gray and medium-dark-gray, very finely and finely crystalline; indistinctly laminated.	3
Covered.	1
Dolomite, medium-light-gray to medium-gray and medium-dark-gray, very finely, finely, and medium crystalline; weathers yellowish gray to light olive gray and light gray and light gray to medium light gray; poorly bedded; few dark-gray nodules and stringers.	14
Dolomite, medium-dark-gray, very finely to finely crystalline; weathers yellowish gray; parting into 1- to 4-inch layers; well laminated on weathered surface; silty laminae in top 1 foot; cross-laminated (right side up) in a bed 5 feet from top; very light gray silty dolomite in top 2 inches.	6

	Feet
Dolomite, medium-gray and medium-dark-gray, finely crystalline; weathers light gray and medium light gray to yellowish gray; parting into 1- to 7-inch layers; some thin siliceous laminae.	3½
Dolomite, silty, medium-dark-gray, very finely crystalline; weathers yellowish gray; parting into ½- to 4-inch layers; platy; fine laminae.	2
Dolomite, light-gray, medium-light-gray, and medium gray, very finely to finely crystalline; two ½-foot zones of abundant silty laminae 1 foot from top and at base.	4
Covered.	4
Dolomite, medium-gray, very finely to finely crystalline; weathers yellowish gray to light olive gray; fine siliceous laminae.	1
Dolomite, medium-gray and medium-dark-gray, very finely and finely crystalline; weathers yellowish gray; parting into 3-inch to 1-foot layers; a 1-inch thick lens of dark-gray and light-gray mottled chert located 3½ feet above base.	8
Dolomite, silty, light-gray and light- to medium-light-gray, finely to medium crystalline; fine laminae.	2½
Dolomite, medium-gray and medium-dark-gray, finely and finely to medium crystalline; weathers light gray and yellowish gray; parting into 1½- to 4-foot layers; a 1½-foot bed yellowish gray shaly laminated dolomite located 2 feet from top.	7
Dolomite, medium-dark-gray, very finely crystalline; weathers yellowish gray, parting into 1- to 4-inch layers.	1
Dolomite, medium-light-gray and light-gray to light-olive-gray, very finely to finely crystalline; weathers yellowish gray; parting into ½- to 1-foot layers.	1½
Dolomite, medium-dark-gray and medium-gray, very finely crystalline; weathers yellowish gray; parting into 6-inch layers.	2
Dolomite, silty, very-pale-orange to yellowish-gray, very finely crystalline; weathers yellowish gray; parting into 1- to 2-inch layers; fine laminae.	1½
Dolomite, medium-light-gray and medium-gray, finely crystalline; weathers yellowish gray; parting into 1-foot layers.	2
Covered.	3
Dolomite, medium-light-gray, finely crystalline; fine siliceous laminae.	1
Dolomite, medium-dark-gray, finely crystalline; coarse crystalline patches in an 8-inch zone located 1 foot from top; parting into 7-inch to 1-foot layers.	4
Covered.	3
Dolomite, medium-gray, very finely crystalline; weathers yellowish gray to very pale orange; fine laminae.	1
Covered.	1
Dolomite, medium-gray, very finely crystalline; parting into 4- to 6-inch layers.	2
Covered.	2
Dolomite, medium-light-gray, very finely crystalline; fine laminae.	1
Covered.	2½
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers yellowish gray and light gray to yellowish orange; parting into 1- to 5-inch layers; fine siliceous laminae spaced about	

	Feet
1 inch apart; 3-inch zone of finely laminated light gray siliceous dolomite located 5 feet from top.	6½
Dolomite, medium-light-gray and medium-gray, very finely crystalline; weathers yellowish gray; parting into 2- to 5-inch layers; fine siliceous laminae occur in ½- to 2-inch zones spaced 2 to 3 inches apart; some light-gray laminae up to ¼-inch thick.	5½
Dolomite, medium-light-gray, medium crystalline; light-gray to yellowish-gray patches and streaks.	3
Dolomite, medium-gray, finely crystalline; weathers light gray to yellowish gray; poorly bedded; some siliceous laminae.	7½
Covered.	6–8
Dolomite, medium-light-gray and medium-gray, medium and coarsely crystalline; very-light-gray mottling; few thin zones of medium-gray fine crystalline dolomite.	7½
Dolomite, light-gray and medium-light-gray finely, crystalline; weathers yellowish gray; parting into 5- to 10-inch layers; fine, very light gray laminae throughout; ½-inch vugs in upper ½ foot; floating, rounded quartz sand grains in part.	4½
Covered.	4
Dolomite, medium-light-gray to medium-gray, very finely and finely crystalline; weathers yellowish gray and light olive gray; parting into indistinct 3- to 8-inch layers; sandy laminae in upper 1 foot and in a 1-foot zone 2 feet below top; floating, rounded quartz sand grains present throughout unit but scarce toward base; abundant siliceous laminae; some soft-sediment deformation of laminae.	6
Dolomite, medium- and medium-dark-gray, very finely and finely crystalline; indistinct bedding.	3
Dolomite, medium-dark-gray, finely crystalline; weathers light gray to medium light gray; parting into 2- to 4-inch layers; a 2-inch platy zone occurs ½ foot from top.	1½
Dolomite, medium-gray, finely crystalline; weathers yellowish gray; laminated; abundant floating, rounded quartz sand grains present throughout unit.	2
Dolomite, light-gray and medium-light-gray, finely crystalline; weathers yellowish gray; parting into 1-foot layers.	3
Covered.	1
Dolomite, medium-dark-gray, very finely crystalline; laminated.	½
Dolomite, medium-gray and medium-dark-gray, very finely and finely crystalline; weathers very light gray; parting into 4-inch to 2-foot layers; color laminated in part.	3½
Dolomite, medium-light-gray and medium-gray, finely to medium crystalline; some mottles; massive; upper 3 inches contain very light gray laminae and cross-laminae up to ⅛-inch thick.	3
Covered.	3
Dolomite, very-light-gray and medium-light-gray, finely crystalline; some mottling; weathers very pale orange; laminated in upper 1 foot and lower 3 feet; abundant floating, rounded quartz sand grains in upper 1 foot.	6½
Covered.	1½
Dolomite, medium-light-gray and light-gray, very finely and finely crystalline; parting into 3- to 4-inch layers; color laminated; few siliceous laminae.	1½
Covered interval. Stratigraphic thickness calculated using bedding	

	Feet
attitude, and direction and distance between exposures. Stratigraphic thickness:	60–65
Dolomite, medium-gray, finely to medium crystalline; weathers yellowish gray.	2
Covered.	1
Dolomite, medium-gray, finely to medium crystalline; weathers light gray.	1½
Covered interval containing rusty, silty dolomite and siltstone float.	8
Dolomite, medium-light-gray, finely crystalline; weathers yellowish gray; parting into 3- to 5-inch layers; few silty laminae.	2½
Dolomite, medium-dark-gray, finely crystalline; parting into 6-inch layers.	1½
Covered.	1
Dolomite, medium-dark-gray, medium crystalline, sparkling; parting into 3- to 8-inch layers.	2½
Dolomite, medium-light-gray and medium-gray, finely to medium crystalline; weathers yellowish gray; parting into 6-inch layers.	2½
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish gray; parting into 1- to 4-inch layers.	1
Covered interval containing rusty siltstone float.	1
Dolomite, medium-gray, finely crystalline; parting into 1- to 6-inch layers; finely laminated on weathered surface.	1½
Dolomite, medium-gray, very finely and finely crystalline; weathers yellowish gray; parting into ½- to 1-foot layers; 1-foot zone of indistinct laminae on weathered surface 2 feet from base.	9½
Covered.	2
Dolomite, medium-dark-gray, finely crystalline; weathers yellowish gray to light olive gray; parting into 1- to 6-inch layers; laminae up to ¼-inch thick visible on weathered surfaces.	2½
Dolomite, medium-light-gray and medium-gray, finely to medium crystalline; weathers yellowish gray; parting into 1- to 2-foot layers.	3½
Dolomite, medium-gray, very finely crystalline; weathers yellowish gray to light olive gray; parting into 1- to 2-inch layers; shaly.	1
Dolomite, medium-gray and medium-light-gray, very finely and finely crystalline; weathers yellowish gray; parting into 1-inch to 1-foot layers; few zones of irregularly spaced fine laminae.	10½
Dolomite, medium-gray and medium-dark-gray, very finely and finely crystalline; weathers yellowish gray to light olive gray; well bedded, parting into 1- to 6-inch layers; regular distinct laminae, some silty laminae up to ¼ inch thick.	27½
Dolomite, medium-light-gray to medium-gray, very finely and finely crystalline; weathers yellowish gray to pale olive; parting into 2- to 8-inch layers; few faint laminae on weathered surfaces.	2½
Dolomite, medium-gray to medium-dark-gray, very finely to finely crystalline; parting into ½- to 1-inch layers; regular distinct laminae, some silty laminae and thin silty beds.	2½
Covered.	1
Dolomite, medium-gray, finely crystalline, sparkling; parting into 1- to 6-inch layers; shaly in lower ½ foot.	3
Covered.	1
Dolomite, medium-gray, very finely and finely crystalline; weathers yellowish gray to dusky yellow; parting into ½- to 3-inch layers; regular distinct laminae, silty weathering laminae up to ¼ inch thick.	4½

	Feet
Dolomite, medium-gray to medium-dark-gray, very finely and finely crystalline; weathers yellowish gray and medium light gray; parting into 2- to 9-inch layers, well bedded.	1½
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers grayish yellow to yellowish gray; parting into ½- to 2-inch layers; distinct regular laminae on weathered surfaces.	1
Dolomite, medium-gray, very finely crystalline; weathers yellowish gray to grayish yellow; parting into ½- to 3-inch layers; shaly in lower ½ foot.	2
Dolomite, medium-gray, very finely to finely crystalline; weathers yellowish gray; parting into ½- to 3-inch layers.	2
Dolomite, medium-gray and medium-dark-gray, very finely to finely crystalline; weathers yellowish gray to medium light gray; parting into ½- to 3-inch layers; distinct, mostly regular laminae up to ¼-inch thick; a 1½-inch bed of finely brecciated dolomite occurs 3 feet from top.	6
Dolomite, medium-gray and medium-dark-gray, finely to medium crystalline; weathers medium light gray and yellowish gray.	5
Covered interval. Stratigraphic thickness calculated using bedding attitude, and direction and distance between exposures. Stratigraphic thickness:	180–200
Dolomite, medium-gray, very finely crystalline; weathers yellowish gray; parting into 3½- to 8-inch layers; few siliceous laminae, a 10-inch bed of medium gray, finely crystalline limestone occurs 1 foot from top.	4
Covered.	2–3
Dolomite, medium-gray, very finely crystalline.	1
Covered.	1
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers very light gray to light gray and yellowish gray; parting into ½- to 1-foot layers.	2
Dolomite, medium-gray, very finely crystalline; weathers very light gray to light gray and yellowish gray; parting into 2-inch layers; wavy siliceous laminae up to ⅛-inch thick; some color laminae on weathered surfaces.	2½
Covered.	3½
Dolomite, medium-gray, very finely crystalline; weathers very pale orange to yellowish gray; poorly bedded.	4
Dolomite, medium-gray; weathers light gray to yellowish gray; strongly laminated with alternating layers of very finely crystalline and finely crystalline dolomite in upper 1½ feet and lower 1½ feet; lower 1½ feet is platy and silty.	4½
Covered interval. Stratigraphic thickness calculated using bedding attitude, and direction and distance between exposures. Scattered small outcrops of light gray and medium-gray dolomite (total 4 feet), and light gray to light-brownish-gray and medium-gray limestone (total 4 feet) occur in covered interval. Stratigraphic thickness:	75–85
Limestone, medium-gray to medium-dark-gray, finely and coarsely crystalline; weathers medium light gray to medium gray; laminated with layers up to ½-inch thick of very finely, finely and medium crystalline limestone; a few medium-gray dolomite laminae	

	Feet
up to ½-inch thick; 3-inch laminated medium-gray dolomite bed at top.	3
Covered.	1½
Limestone, medium-light-gray, medium crystalline; indistinct cleavage laminae; silty patches on weathered surface.	2
Dolomite, medium-gray, very finely crystalline; weathers yellowish gray; parting into 1½- to 5-inch layers, few indistinct laminae on weathered surface; unit pinches and swells laterally.	1
Limestone, medium-gray, finely and medium crystalline; indistinct cleavage laminae; silty patches on weathered surface.	2½
Dolomite, medium-gray, very finely crystalline; weathers grayish yellow and light olive gray; parting into 1- to 2-inch layers; color laminae up to ¼-inch thick on weathered surface; silty in part.	1
Limestone, light-gray, medium-light-gray and medium-gray, medium and coarsely crystalline; weathers light gray; parting into 2-inch layers in upper ½ foot, remainder indistinctly bedded; a 3-inch bed of medium-dark-gray, very finely crystalline dolomite occurs ½ foot from top and another at base of unit.	5
Covered.	1
Interlaminated limestone and dolomite, medium-gray and medium-dark-gray, very finely crystalline dolomite, and finely to medium crystalline limestone; weathers light gray and dolomite weathers yellowish gray; laminae up to ½-inch thick.	2
Covered.	1½
Limestone, medium-light-gray, medium crystalline; laminated.	1
Traverse 75 feet west parallel to strike. Section continues along east edge of Conestoga Creek. Covered interval determined by calculation using attitude of rocks and elevation change. Stratigraphic position confirmed by correlation of rocks. Covered.	3
Limestone, medium-gray and medium-dark-gray, very finely and finely crystalline; silty laminae up to ¼-inch thick weather into conspicious ribs.	3
Covered.	2
Limestone, medium-light-gray and medium-gray, very finely, finely and medium crystalline; parting into 1- to 2-inch layers; strongly laminated with abundant silty laminae up to ½-inch thick; two 2- to 3-inch beds of medium-light-gray dolomite occur in this unit.	4
Covered interval except for a few small separated exposures of very-light-gray and light-gray, silty limestone.	7
Dolomite, light-gray, medium-light-gray, light-olive-gray, and pinkish-gray, cryptocrystalline; parting into 1-inch to 1-foot layers; color laminated; some silty laminae; a 3-inch bed of medium-gray, finely to medium crystalline limestone occurs 1 foot from top of unit.	6
Dolomite, medium-light-gray and medium-gray, very finely crystalline; parting into 1- to 4-inch layers; well laminated; silty laminae up to ½-inch thick.	7
Covered.	1½
Dolomite, medium-light-gray and medium-gray, very finely crystalline; parting into 5- to 8-inch layers; indistinctly laminated in upper ½ foot.	3
Dolomite, medium-dark-gray, finely crystalline and cryptocrystalline.	3

	Feet
Covered.	1
Dolomite, medium-gray, very finely and finely crystalline; parting into 3- to 6-inch layers; some siliceous laminae.	4
Covered.	2½
Dolomite, medium-dark-gray, very finely crystalline; parting into 1-inch to 1-foot layers; silty laminae up to ¼ inch thick; platy in part.	4
Covered.	7
Limestone, medium-gray to medium-dark-gray, finely crystalline; abundant silty laminae.	1
Covered.	½
Dolomite, medium-light-gray, very finely crystalline.	1
Covered.	1
Dolomite, medium-light-gray to medium-gray, very finely crystalline; parting into 1- to 4-inch layers; silty in part.	1½
Covered.	1
Dolomite, medium-gray, very finely crystalline; parting into 1-inch to 1-foot layers; silty laminae in most beds.	8½
Covered.	1½
Dolomite, medium-gray, very finely crystalline; some siliceous laminae spaced 1 to 3 inches apart; some fine color laminae in lower part.	1½
Covered.	1
Dolomite, medium-light-gray and light-gray, very finely crystalline; weathers very pale orange to yellowish gray; parting into ½- to 1½-foot beds.	6
Dolomite, medium-light-gray to medium-gray, very finely crystalline; weathers very pale orange to yellowish gray; parting into 1- to 5-inch layers; silty laminae up to 1 inch thick; mud cracks in some beds.	3
Dolomite, medium-light-gray to medium-gray, very finely crystalline; parting into 4- to 5-inch layers; silty laminae in lower 1½ feet.	3
Covered.	7½
Dolomite, medium-gray, very finely crystalline; fine silty laminae up to ⅛ inch thick throughout unit.	1½
Covered.	1
Limestone, medium-light-gray, medium crystalline; fine silty laminae throughout unit.	½
Dolomite, medium-gray, cryptocrystalline to very finely crystalline.	½
Limestone, medium-dark-gray, finely and medium crystalline.	1
Dolomite, medium-gray, very finely crystalline; color laminated.	1
Covered.	1
Dolomite, medium-gray, very finely and finely crystalline; parting into 1- to 3-inch layers; silty laminae or silty beds occur throughout the unit.	2
Covered.	20
Dolomite, medium-light-gray and medium-gray, very finely crystalline; contains silty laminae.	1½
Covered.	1½
Dolomite, medium-gray, very finely crystalline; contains very distinct silty laminae.	2½

	Feet
Covered.	5
Dolomite, medium-light-gray, very finely crystalline.	1
Traverse 400–500 feet westward across Conestoga Creek. Section continues on west side of paper mill above creek. Covered interval determined by calculation using attitude of rocks and elevation change.	—
Covered.	40
Dolomite, silty, light-gray, light-olive-brown, medium-light-gray, and medium-gray, very finely and finely crystalline; weathers moderate yellowish brown to dark yellowish brown, grayish orange, and light olive gray; parting into 1- to 5-inch layers; most beds regularly laminated; laminae defined by increased silt content; wave ripple marks (beds right side up) 1 foot from top; contains two shaly zones 2 to 4 inches thick; some indistinct mud cracks.	7
Dolomite, silty, medium-light-gray and medium-gray, very finely to finely crystalline; weathers dark yellowish orange to light brown and light olive gray; parting into 5-inch to 1-foot layers; fine regular laminae; some cross lamination.	3
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers light gray; parting into 1½- to 4-inch layers; regular silty laminae.	1½
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers dark yellowish orange and light olive gray; parting into 1- to 4-inch layers; finely laminated or widely spaced silty laminae; lower 1 foot silty.	2
Limestone, light-gray, mottled, very finely to finely crystalline; weathers light gray.	½
Dolomite, medium-light-gray, finely to medium crystalline; weathers yellowish gray; parting into ½- to 1-foot layers; 1-inch silty zone near middle.	2½
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers yellowish gray and light gray; parting into 1- to 5-inch layers; lower 8 inches are silty and weather moderate yellowish brown; fine regular laminae to more widely spaced laminae on weathered surface.	5
Dolomite, medium-gray and medium-light-gray, very finely and finely crystalline; weathers yellowish gray to grayish yellow; parting into 2- to 4-inch layers.	4
Dolomite, light-gray, medium-light-gray, and medium-gray, very finely and finely crystalline; weathers very pale orange to very light gray; parting into 2- to 5-inch layers.	4½
Dolomite, silty, light-olive-gray to medium-light-gray, very finely crystalline; weathers yellowish gray; parting into ½- to 2-foot layers; 1-inch laminated zone of calcareous siltstone 2 feet from top; wavy, silty laminae in lower 2 feet.	5
Covered.	2–3
Dolomite, medium-light-gray, medium-gray, and medium-dark-gray, very finely and finely crystalline; parting into 4- to 10-inch layers; fine laminae spaced about ½ inch apart; 3-inch medium gray, very finely crystalline limestone bed 1 foot from bottom.	7
Dolomite, medium-gray and medium-dark-gray, very finely and	

	Feet
finely crystalline; weathers grayish yellow; parting into 3- to 5-inch layers.	5
Covered.	1
Dolomite, silty, medium-light-gray to light-olive-gray, finely crystalline; weathers moderate yellowish brown; parting into 1½- to 5-inch layers; contains unevenly spaced fine laminae; mud cracks in some beds.	2
Dolomite, medium-light-gray to medium-dark-gray, very finely and finely crystalline; weathers yellowish gray; parting into 3-inch layers; contains unevenly spaced fine laminae near middle of unit.	7
Dolomite, silty, light-gray, medium-light-gray, and light brownish-gray; very finely crystalline; parting into ½- to 2-inch layers; contains fine regular laminae; platy; mud cracks in some beds.	1
Dolomite, medium-light-gray to medium-gray, very finely crystalline; weathers very pale orange to yellowish gray; parting into 1½- to 6-inch layers; few fine laminae and cross laminae (right side up) in lower 4 inches.	4
Dolomite, medium-dark-gray, cryptocrystalline to very finely crystalling; weathers light olive gray; parting into 1- to 4-inch layers; some indistinct laminae; two shaly zones in lower part containing disseminated pyrite.	3
Dolomite, medium-light-gray to light-brownish-gray, and medium-gray, very finely and finely crystalline; weathers light gray, pinkish gray, and yellowish gray; parting into 2- to 10-inch layers; contains regular fine laminae; 4-inch shaly zone in middle containing disseminated pyrite.	3
Dolomite, medium-light-gray to medium-gray, very finely to finely crystalline; weathers yellowish gray to light olive gray; parting into 4-inch to 1½-foot layers; contains regular fine laminae in lower two thirds of unit; a 3-inch shaly zone occurs 3 feet from top; ½-foot light-brownish-gray, finely crystalline limestone lens at top.	10½
Dolomite, medium-gray and medium-dark-gray, finely and medium crystalline; weathers light gray; parting into 2- to 6-inch layers, poorly bedded.	3
Dolomite, medium-gray, light-brownish-gray, and medium-light-gray, very finely crystalline; weathers yellowish gray and dark yellowish orange; parting into 1- to 6-inch layers; contains very distinct fine regular laminae; silty in part; ¼-inch black laminae in bottom ½ foot, scattered pyrite.	14
Limestone, medium-gray, finely crystalline; some light gray mottles; weathers mottled light and medium gray; parting into 1- to 10-inch layers; contains disseminated pyrite.	2
Dolomite, medium-light-gray, medium-gray, and light-gray, very finely and finely crystalline; weathers yellowish gray, very distinct regular color and silty laminae; silty in part; float contains excellent mud cracks.	8
Limestone, very-light-gray, medium crystalline; weathers very pale orange; cleavage laminated.	½
Dolomite, silty, pale-yellowish-brown, very finely and finely crystalline; weathers yellowish gray; parting into 2- to 8-inch layers; color laminated.	2
Dolomite, light-gray, and light-brownish-gray, very finely and finely crystalline; weathers grayish orange to yellowish gray; part-	

Feet	
ing into 2- to 5-inch layers; some yellowish gray dolomite with light gray laminae near top, remainder contains silty laminae up to ¼ inch thick; grades into medium dark gray platy and shaly dolomite near base.	5
Covered.	30
Dolomite, medium-dark-gray, medium-gray, and light-gray, very finely crystalline; weathers yellowish gray; parting into 3-inch to 1-foot layers; laminated; some finely to medium crystalline laminae; contains disseminated pyrite.	12
Limestone, medium-dark-gray, very finely and medium crystalline; weathers medium light gray; contains patches and stringers of dolomite.	1½
Dolomite, medium-gray, finely crystalline; weathers grayish orange; parting into 4- to 10-inch layers; lower half laminated on weathered surface.	2½
Limestone, light-gray to medium-light-gray, finely crystalline; weathers very light gray to light gray; pinches and swells.	½
Dolomite, medium-light-gray, medium-gray, and medium-dark-gray, finely to medium crystalline; weathers very pale orange; parting into 3- to 15-inch layers; contains two ½-foot thick laminated shaly to platy dolomite zones; some mud cracks visible.	13½
Limestone, white to medium-light-gray, finely and coarsely crystalline; weathers very light gray and light gray.	½
Dolomite, silty, pale yellowish-brown to light-olive-gray, very finely and finely crystalline; weathers very pale orange; parting into 3- to 10-inch layers; few ⅛- to ¼-inch laminae; ½-foot dolomitic sandstone at top.	6½
Dolomite, medium-light-gray and medium-gray, very finely and finely crystalline; parting into 2- to 4-inch layers; indistinctly laminated; few ¼-inch shale laminae; silty in part; disseminated pyrite in lower 1 foot.	8½
Covered interval. Stratigraphic thickness calculated using bedding attitude, and direction and distance between exposures. Stratigraphic thickness:	250–275
Dolomite, medium-gray, very finely crystalline; weathers very pale orange and yellowish gray; parting into ½-inch to 8-inch layers; unevenly spaced laminae; some indistinct cross laminae; 2-inch sandstone bed near middle.	3½
Dolomite, medium-light-gray and medium-gray, very finely crystalline; weathers yellowish gray; parting into 1-inch to 1-foot layers; ⅛- to ¼-inch shaly laminae spaced several inches apart.	11
Dolomite, medium- to medium-dark-gray, very finely and finely crystalline; weathers yellowish gray to pale olive; parting into 2- to 6-inch layers.	2
Dolomite, medium-light-gray, medium crystalline, sparkling; indistinct light gray mott es.	1½
Covered.	0–2
Dolomite, medium-light-gray, medium crystalline, sparkling; weathers yellowish gray and light gray; parting into 2- to 6-inch layers.	4½
Dolomite, medium-light-gray, very finely to finely crystalline; parting into 6- to 12-inch layers.	3

	Feet
Dolomite, medium-light-gray to medium-gray, very finely crystalline; weathers light gray and yellowish gray; parting into 1- to 4-inch layers; laminated in part.	4
Covered.	5
Dolomite, silty, light-gray to light-brownish-gray, very finely crystalline.	2
Dolomite, very-light-gray to medium-light-gray, medium and coarsely crystalline, weathers light gray; parting into ½- to 1½-foot layers; ⅛- to ¼-inch laminae spaced 1 to 3 inches apart on weathered surface.	3
Covered.	5
Dolomite, medium-light-gray to medium-gray, very finely to finely crystalline; parting into ½- to 1-foot layers.	1½
Dolomite, medium-light-gray to medium-gray, medium and coarsely crystalline; sparkling; weathers very light gray; indistinct parting into 4-inch to 1-foot layers; faint laminae on weathered surface in part.	10
Dolomite, medium-light-gray and medium-gray, very finely to finely crystalline; parting into 4-inch to 1-foot layers; faintly laminated in upper 7 feet; well laminated in bottom 2 feet.	9
Covered interval. Stratigraphic thickness calculated using bedding attitude, and direction and distance between exposures. Stratigraphic thickness:	80–100
Dolomite, silty, pinkish-gray, grayish-orange-pink, and very pale orange, cryptocrystalline to very finely crystalline; weathers grayish yellow to yellowish gray; parting into 1- to 3-inch layers; fine prominent siliceous laminae; micaceous partings.	4½
Dolomite, very pale orange to pinkish-gray to white, cryptocrystalline to very finely crystalline; weathers very pale orange to very light gray; parting into 4-inch to 1½-foot layers; few faint laminae on weathered surface.	4
Dolomite, white to very pale orange, cryptocrystalline to very finely crystalline; weathers white to very light gray; fine regular to anastomosing laminae on weathered surface.	1½
Dolomite, light-gray, pinkish-gray to very pale orange, cryptocrystalline to very finely crystalline; weathers very pale orange to yellowish gray; parting into ½- to 1-foot layers; faint laminae on weathered surface in part.	3½
Covered.	1
Dolomite, pinkish-gray to very-light-gray, very finely crystalline.	1
Dolomite, medium-light-gray to medium-gray, cryptocrystalline to very finely crystalline and very finely crystalline; weathers very pale orange to yellowish gray; parting into 4-inch to 1-foot layers.	3½
Dolomite, light-gray to medium-gray, finely to medium crystalline, sparkling; some darker laminae on fresh surface.	7
Dolomite, light-gray to medium-light-gray and medium-gray, very finely crystalline; parting into 6-inch layers; faint laminae.	1½
Dolomite, very pale orange to yellowish-gray and light-gray, cryptocrystalline and very finely crystalline; parting into 3- to 8-inch layers; some faint laminae; bottom 1½ feet is silty.	5½
Covered.	1
Dolomite, silty, very pale orange to yellowish-gray, very finely crystalline; weathers moderate yellowish brown to dark yellowish	

	Feet
orange; parting into 2- to 6-inch layers; unevenly spaced laminae.	3½
Dolomite, pinkish-gray, finely to medium crystalline; weathers very light gray; well laminated on weathered surface.	1
Dolomite, medium-light-gray and medium-gray, finely to medium crystalline; parting into 7- to 10-inch layers; some faint laminae; bedding N 75° E, 35° S.	5½
Covered.	4
Dolomite, medium-gray, very finely to finely crystalline; weathers light gray to yellowish gray; parting into 1- to 6-inch layers; faint laminae on weathered surface.	1½
Covered.	10
Dolomite, silty, very pale orange, very finely crystalline; weathers yellowish gray to grayish orange; parting into ½- to 6-inch layers; few faint laminae on weathered surface.	5
Dolomite, very pale orange to white and light olive gray to white, very finely crystalline; weathers very pale orange and yellowish gray; parting into 1½- to 10-inch beds; some beds are faintly laminated on weathered surface; several ¼- to 1-inch thick zones of platy laminae.	7
Dolomite, medium-light-gray and yellowish-gray to light-olive-gray, very finely crystalline; parting into 1- to 3-inch layers; platy.	1½
Dolomite, medium-light-gray, very finely crystalline; weathers yellowish gray; parting into 4- to 8-inch layers; some beds are laminated on weathered surface.	3
Dolomite, medium-gray, finely to medium crystalline; light-gray mottles; weathers light gray to medium light gray; parting into 2- to 12-inch layers.	2
Dolomite, medium-light-gray and medium-gray, very finely crystalline; weathers yellowish gray and light gray; parting into 2- to 10-inch layers.	5
Dolomite, medium-light-gray and light-gray, very finely crystalline; weathers yellowish gray; parting into 1½- to 6-inch layers; few platy laminae.	4
Dolomite, medium-light-gray to medium-gray, finely and medium crystalline, massive; few faint laminae on weathered surface in upper 4 feet.	11
Covered.	3
Dolomite, medium-light-gray and medium-gray, very finely and finely crystalline; weathers light gray and yellowish gray; parting into 1- to 4-inch layers; finely laminated on weathered surface; ⅛-inch siliceous laminae spaced ½- to 4-inches apart.	5½
Dolomite, light-gray and medium-light-gray, medium and coarsely crystalline, sparkling; some darker mottles; weathers very light gray and light gray; massive except for 1 foot layer at top.	9
Dolomite, medium-light-gray and medium-gray, finely crystalline; parting into 2- to 10-inch layers; few ⅛- to ¼-inch siliceous laminae.	8½
Ledger Formation	
Dolomite, light-gray, medium to coarsely crystalline, sparkling; medium-gray mottles; weathers light gray; massive.	20+
Total	1588½–1644½

Section 4

Section along Pennsylvania railroad right of way located 0.2 miles west of Salunga or approximately at 40°06′20″ N latitude and between 76°26′05″ W and 76°26′20″ W longitude. Section begins at west end with beds overturned and dipping south.

(Measured by A. Becher)

Upper Cambrian
Conococheague Group
Buffalo Springs Formation

	Feet
Dolomite, grayish-pink to pale-yellowish-brown, very finely crystalline; weathers pale to dark yellowish orange; parting into ½- to 3-inch layers; laminae and thin beds containing very fine-grained quartz sand near top and bottom of unit.	1
Dolomite, light-gray to light-brownish-gray, very finely crystalline; weathers grayish orange to grayish yellow; parting into 3- to 6-inch layers; finely veined with calcite.	1
Limestone, light-gray, croptocrystalline to very finely crystalline; weathers very light gray to light gray; grayish-pink to pale red laminae up to 1½ inches thick which weather very pale orange to moderate orange pink.	1
Covered.	3½
Limestone, very light-gray and light-brownish gray, very finely crystalline; weathers very light gray and pinkish gray; stylolitic laminae in upper 8 inches; small cryptozoon 8 inches from top; grayish orange weathering dolomitic patches and masses in lower 9 inches.	2
Limestone, medium-gray to medium-light-gray, finely crystalline; weathers medium light gray; oolitic in upper 4 inches; grades downward to grayish orange weathering dolomite containing lenses and patches of very fine-grained quartz sand which weather dark yellowish brown; veined with calcite and quartz in lower part.	1
Limestone, medium-light-gray to light-brownish-gray, very finely to finely crystalline; weathers white to light brownish gray; few stylolitic laminae.	1½
Covered.	9
Dolomite, argillaceous, medium-gray, very finely crystalline; weathers olive gray and moderate yellowish brown; some fine bedding laminae.	1½
Covered.	3
Dolomite, argillaceous, light-olive-gray and medium-gray, very finely crystalline; weathers dark yellowish orange and light brown; parting into 4- to 12-inch layers; laminae containing silt and very fine-grained quartz sand; some indistinct ripple marks; platy in zones of parting.	4
Covered. Probably argillaceous dolomite.	11
Limestone, light-gray to light-brownish-gray, finely crystalline; weathers light gray; some stylolitic laminae.	2
Dolomite, medium-light-gray to light-olive-gray, very finely crystalline; weathers moderate yellowish brown; limestone stringers in upper 3 inches, grading to laminae at base.	½

	Feet
Limestone, light-gray to light-brownish-gray, very finely crystalline; weathers very light gray; fine irregular dolomitic laminae in lower 3 inches; oolitic in upper 3 inches; some flat dolomite pebble conglomerate at base.	½
Dolomite, medium-light-gray to light-brownish-gray, very finely crystalline; weathers grayish orange and light brown; abundant yellowish brown weathering laminae; mud cracks; fine calcite veins perpendicular to bedding; coarsely crystalline patches of calcite in lower 1 foot.	5
Covered.	4½
Dolomite, medium-light-gray, very finely crystalline; weathers pale yellowish orange and grayish orange; parting into 4- to 9-inch layers; laminae containing very fine-grained quartz sand; rare lenses of coarsely crystalline calcite.	2
Covered.	4
Dolomite, medium-gray, very finely crystalline; weathers moderate yellowish brown; fine color laminae; pods and stringers of medium-dark-gray limestone containing pyrite.	1½
Covered.	2
Limestone, medium-gray, very finely crystalline; fine dolomitic and argillaceous laminae and cross-laminae; some coarsely crystalline calcite patches; fissile in upper 4 inches.	½
Dolomite, light-gray to medium-light-gray, very finely crystalline; weathers moderate yellowish brown; parting into 1- to 7-inch layers; some indistinct laminae; few limestone stringers in lower 3 inches; argillaceous in part.	1½
Covered.	2½
Limestone, dolomitic, pinkish-gray and yellowish-gray to medium-light-gray, very finely crystalline; weathers pinkish gray to grayish orange; parting into 4- to 6-inch layers; fine bedding laminae in part; dolomite in disseminated grains and stringers; 2-inch dolomite bed near top of unit; erosional contact with underlying unit.	2
Dolomite, grayish-orange to pale-yellowish-brown, very finely crystalline; weathers dark yellowish orange to light brown; parting into 4-inch layers; platy in part; fine veins of quartz and calcite.	1
Covered.	8
Dolomite, medium-gray, very finely crystalline; weathers light olive gray and yellowish gray to grayish orange; parting into 1- to 5-inch layers; moderate brown weathering laminae up to 1 inch thick; a 3-inch fissile, argillaceous bed occurs 2 feet from top and a 4-inch fissile, argillaceous bed with disseminated pyrite 1½ feet from base; indistinct ripple marks.	4
Covered.	1½
Dolomite, argillaceous, medium-gray, very finely crystalline; deeply weathered, weathers dark yellowish orange to dark yellowish brown; laminated.	1½
Covered.	2½
Dolomite, medium-dark-gray, very finely crystalline; weathers yellowish gray to grayish orange; parting into 1- to 3-inch layers; few laminae, argillaceous in part.	1½
Covered.	3

	Feet
Limestone, medium-dark-gray, finely crystalline; weathers light gray; some anastomosing silty or dolomitic laminae.	1
Covered.	3½
Dolomite, medium-gray to medium-dark-gray, very finely and finely crystalline; weathers light olive gray and yellowish gray to grayish orange; parting into 6- to 18-inch layers; a 1-foot laminated, platy, mud-cracked zone occurs 1½ feet from base.	6
Covered.	½
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish gray to light olive gray; finely laminated; platy in part.	4
Dolomite, medium-gray, very finely crystalline; weathers yellowish gray; finely laminated; thickens and thins.	1
Limestone, medium-dark-gray, very finely crystalline; weathers light gray and medium light gray; a distorted ½-inch brown chert bed occurs 3 inches from top; cryptozoon(?) in lower 7 inches.	1
Dolomite, medium-gray, very finely crystalline; weathers very pale orange to yellowish gray; a 1-inch bed of distorted brown chert occurs at top; discontinuous thin zone of disrupted dolomite laminae in a limestone matrix occurs 3 inches below chert bed; cryptozoon 2 to 5 inches across at base; pinches and swells.	1½
Limestone, medium-dark-gray and dark-gray, very finely crystalline; weathers light gray to medium gray; very pale orange weathering dolomitic laminae and thin beds; grayish red to pale brown weathering anastomosing laminae; porous chert zone near middle; micro scale low angle thrust; veins of calcite and quartz.	2
Dolomite, medium-dark-gray, very finely crystalline; weathers grayish orange; laminae spaced 1 to 2 inches apart; 3-inch dark-gray oolitic limestone bed at base grading into overlying dolomite.	1½
Dolomite, light-gray, very finely crystalline; weathers grayish orange to yellowish gray; calcareous in part; 3-inch bed of light gray limestone at base; veins of calcite and quartz.	1½
Covered.	3
Dolomite, light-gray to medium-light-gray, very finely crystalline; weathers yellowish gray; shattered and finely veined with calcite.	1½
Interlaminated limestone and dolomite; limestone, oolitic or pelletal medium-light-gray to grayish-purple, very finely and finely crystalline; weathers medium gray to light brownish gray; dolomite, pale-yellowish-brown, very finely crystalline; weathers yellowish gray to grayish orange.	1½
Dolomite, medium-gray, very finely crystalline; weathers yellowish gray to grayish orange; parting into 2- to 5-inch layers; laminated in part; some flat pebble conglomerate; thin limestone lens 3 inches from top.	1½
Limestone, medium-dark-gray, finely crystalline; weathers light gray; some discontinuous dolomitic laminae; few stylolitic laminae; some flat dolomite pebble conglomerate near base; some fossile detritus and oolites.	½
Dolomite, medium-light-gray to medium-dark-gray, very finely crystalline; weathers yellowish orange to dark yellowish brown;	

	Feet
parting into 6- to 18-inch layers; slightly anastomosing laminae in most beds; few cross-laminae; a 2-inch light gray limestone bed occurs 1 foot from top and a 3-inch medium-light-gray limestone bed containing disseminated pyrite occurs 2 feet from top; dark gray fissile shale in thin zone 4 feet from top; few mud cracks and flow casts.	6
Covered.	1
Dolomite, medium-gray and medium-dark-gray, very finely crystalline, weathers grayish orange and moderate yellowish brown; parting into 1- to 4-inch layers; few fine laminae; several fissile zones; gradational from underlying unit.	3½
Limestone, medium-gray to medium-dark-gray, very finely and finely crystalline; weathers light gray to medium light gray; parting into 1- to 2-foot layers; few stylolitic laminae; dolomite in disseminated grains and irregular laminae and patches; ½-foot dark-gray dolomite bed occurs 2½ feet from top and is gradational from underlying limestone; 4-inch medium-dark-gray dolomite bed occurs 1½-feet from top and is gradational from underlying limestone; some pelletal beds; lower ½ foot fissile.	4½
Dolomite, medium-light-gray to dark-gray, very finely crystalline; weathers yellowish gray to grayish orange to moderate yellowish brown; laminated; few wave ripple marks, mud cracks and flow casts; few thin beds of flat limestone pebble conglomerate with fine-grained quartz sand.	8
Dolomite, medium-gray, very finely crystalline; weathers yellowish gray; cryptozoon from 2 to 3 inches to 1 foot across; veins of calcite perpendicular to bedding.	1
Limestone, oolitic, medium-dark-gray, very finely crystalline; weathers medium light gray; dolomite replacing oolites and in laminae; 3-inch medium-gray dolomite bed at base grading into overlying limestone.	1
Limestone, medium-gray and medium-dark-gray, very finely crystalline; weathers light gray to medium light gray; very irregular anastomising dolomitic laminae and patches, oolitic in upper ½ foot with dolomite replacing some oolites and fine, more regular dolomitic laminae.	2
Dolomite, light-gray and medium-light-gray, very finely crystalline, weathers moderate yellowish brown to moderate brown and grayish orange; abundant laminae containing very fine-grained quartz sand; mud cracks; fissile in lower 1 foot.	2
Dolomite, medium-light-gray to light-brownish-gray, very finely crystalline; weathers very pale orange to grayish orange; parting into 1- to 7-inch layers; few shaly laminae; few laminae and lenses containing fine-grained quartz sand at base.	1½
Limestone, dark gray, cryptocrystalline to very finely crystalline; weathers medium light gray to medium dark gray; dolomitic patches and laminae at base becoming less abundant upward; some very light-gray patches and streaks; gradational from underlying unit.	2
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers grayish orange to moderate brown; parting into 1- to 5-inch layers; abundant laminae and thin beds containing	

	Feet
silt and very fine-grained quartz sand; few dark-gray shale laminae; few mud cracks; fissile to platy near middle; some disseminated pyrite.	4
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish-gray; parting into 2- to 5-inch layers; grades upward into a dolomitic and shaly, laminated 5-inch limestone bed which is sparsely oolitic at the base; thick calcite veins perpendicular to bedding.	1½
Dolomite, medium-gray, very finely crystalline; weathers grayish orange to light brown; laminae containing silt and very fine-grained quartz sand in upper ½ foot; fissile in lower ½ foot.	1
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers very pale orange to yellowish gray; massive; sparse fine laminae containing silt in lower 4 inches; quartz and calcite veins perpendicular to bedding.	2½
Dolomite, medium-gray, very finely crystalline; weathers grayish orange and moderate brown; laminae up to 1 inch thick containing silt; few mud cracks.	1
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers very pale orange to yellowish gray; sparse fine laminae containing silt in lower 4 inches; quartz and calcite veins perpendicular to bedding.	2
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers grayish orange to light brown or moderate brown; abundant laminae up to ½ inch thick containing silt; some cross-laminae; fissile to platy.	2½
Dolomite, medium-gray to medium-dark-gray, very finely to finely crystalline; weathers very pale orange to yellowish gray and light olive gray; parting into 1- to 4½-foot layers; thick laminae at base, becoming finer upward; contains very fine-grained quartz sand in lower 1 foot; 4-inch platy, finely laminated zone 5 feet from base; quartz and calcite veins perpendicular to bedding.	7½
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers grayish orange to light brown or pale reddish brown; parting into 2- to 5-inch layers; abundant laminae and beds containing silt and very fine-grained quartz sand; thin calcareous zone 1 foot from base grading both up and down into fissile dolomite; few mud cracks; disseminated pyrite; platy to fissile.	5½
Interlaminated limestone and dolomite, medium-dark-gray, very finely crystalline to cryptocrystalline; weathers light gray and grayish orange; irregular laminae; grades upward into medium-light-gray, calcareous dolomite with a few silty laminae.	2½
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers grayish orange to moderate brown; parting into 2- to 6-inch layers; few mud cracks; mostly platy to fissile, abundant laminae containing silty and very fine-grained quartz sand.	5
Limestone, light-gray to medium-light-gray, very finely crystalline; weathers very light gray to medium light gray; irregular dolomite laminae in lower 1 foot grading to stylolitic laminae at top; color streaked at top; gradational from underlying unit.	2

	Feet
Dolomite, medium-dark-gray and dark-gray, very finely crystalline; weathers grayish orange pink to yellowish gray; lower 2½ feet contain very fine-grained quartz sand in laminae up to 1 inch thick; laminae thin upwards; indistinctly laminated in upper part, quartz and calcite veins perpendicular to bedding.	4
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers grayish orange to light brown or olive gray; laminae up to 1 inch thick containing silt and very fine-grained quartz sand; few cross laminae; few mud cracks; platy to fissile.	6
Dolomite, medium-gray, very finely crystalline to cryptocrystalline; weathers yellowish gray; parting into 1- to 3-inch layers; faintly laminated; gradational from underlying unit.	1
Dolomite, medium-gray, very finely crystalline; weathers grayish orange and light brownish gray; abundant laminae up to 1 inch thick containing silt and very fine-grained quartz sand; fissile at base.	1½
Limestone, very-light-gray to medium-light-gray, very finely crystalline; weathers white to medium light gray; stylolitic and dolomitic laminae grading into 5-inch yellowish gray weathering dolomite at top.	1½
Dolomite, medium-light-gray to light-brownish-gray, very finely crystalline; weathers yellowish gray to grayish orange; parting into 1- to 5-inch layers with hard silty laminae between layers; finely laminated.	1½
Limestone, light-gray to medium-gray and dark-gray, very finely crystalline; weathers light gray to medium gray; parting into 3- to 5- inch layers; 1-foot laminated yellowish-gray weathering dolomite in middle of unit which grades up and down into limestone with dolomitic laminae; limestone contains disseminated coarse calcite crystals, some normal and reverse micro faults in upper limestone.	2½
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish gray to grayish orange; parting into 1- to 3-inch layers; finely laminated or weathered surfaces; few laminae containing silt or very fine-grained sand near base; 2-inch olive gray weathering platy zone at top; gradational from underlying unit.	1
Dolomite, silty, medium-dark-gray, very finely crystalline; weathers dark yellowish brown to olive gray; parting into ¼- to 5-inch layers; abundant laminae and beds up to 3 inches thick containing very fine-grained quartz sand; 8-inch medium-dark-gray fissile limestone 1½ feet from base; argillaceous in lower 1½ feet; platy in part.	9
Covered.	12
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish gray; parting into 1- to 8-inch layers; finely laminated; few laminae up to 1 inch thick containing very fine-grained quartz sand in lower 1 foot; 3-inch cryptozoon(?) bed 1½ feet from base; platy near top; gradational from underlying unit.	4½
Dolomite, medium-light-gray to medium-dark-gray, very finely crystalline; weathers light olive gray and grayish orange to	

	Feet
yellowish gray; laminated; abundant laminae containing silt and very fine-grained quartz sand in upper 2 feet; platy to fissile; few mud cracks.	3
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers medium light gray; stylolitic laminae; disseminated coarse calcite crystals; 2-inch yellowish gray weathering dolomite at top.	1
Dolomite, medium-gray, very finely crystalline; weathers yellowish gray grading to light olive gray at base; parting into 2- to 7-inch layers; some beds finely laminated; few hard shaly partings; calcareous at top; gradational from underlying unit.	3
Limestone, dark-gray, very finely crystalline; weathers medium gray to medium light gray; few indistinct dolomite laminae and patches; gradational from underlying unit.	½
Dolomite, medium-light-gray to medium-gray, very finely crystalline; weathers yellowish gray grading to light olive gray at base; laminated; laminae and beds up to 4 inches thick containing very fine-grained quartz sand; some hard dark shaly laminae; few cross-laminations and mud cracks; disseminated pyrite; platy to fissile in upper 2½ feet.	4
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers light gray to medium light gray; strong cleavage laminae; color laminated in upper 2 inches; vein of quartz and calcite at base of unit.	1
Dolomite, medium-dark-gray, very finely crystalline; weathers yellowish gray; parting into 3- to 8-inch layers; laminated in lower ½ foot; few hard shaly partings.	4
Limestone, medium-dark-gray; very finely crystalline; weathers light gray; few irregular dolomitic laminae; gradational with overlying and underlying units.	½
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers yellowish-gray.	1
Dolomite, medium-dark-gray, very finely crystalline; weathers light olive gray, grayish orange and moderate yellowish brown; parting into 1- to 7-inch layers; laminae and cross-laminae containing very fine-grained quartz sand; one 7-inch bed of medium-gray sandy dolomite, weathering light brown and containing dark hard shaly partings; platy to fissile at top and bottom.	3½
Limestone, medium-gray, very finely crystalline; weathers light gray to medium light gray; few stylolitic and argillaceous laminae; color bands and streaks; 2-inch fossil detritus zone 1 foot from base.	2
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers light olive gray, grayish orange and light brown; abundant laminae and beds up to 1 foot thick containing silt and very fine-grained quartz sand; cross-lamination; few wave ripple marks; disseminated pyrite; fissile to platy in part.	4
Dolomite, medium-dark-gray, very finely crystalline; weathers grayish orange; parting into 1- to 3-inch layers; lower 6 inches dark gray and platy.	1½

	Feet
Dolomite, medium-dark-gray, very finely crystalline; weathers yellowish gray to grayish orange; parting into 1- to 3-inch layers; laminae containing silt and very fine-grained quartz sand.	1
Dolomite, medium-gray, very finely crystalline; weathers light olive gray to yellowish gray; parting into 1-inch and 12- to 15-inch layers; 3-inch fissile zone 5 inches from base.	3
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers light olive gray and yellowish gray to grayish orange; parting into 4- to 18-inch layers; laminae in lower 1 foot decreasing in abundance upward; 5-inch thick medium-gray lensing limestone at top which contains disseminated dolomite grains; gradational from underlying unit.	2½
Dolomite, medium-dark-gray and dark-gray, very finely crystalline; weathers yellowish gray to grayish orange to light brown; parting into 4- to 10-inch layers; laminae containing silt and very fine-grained quartz sand predominantly in upper 3½ feet; few wave ripple marks; some hard dark shaly laminae in lower 2 feet.	5
Covered.	6
Dolomite, medium-dark-gray, very finely crystalline; weathers light olive gray to yellowish gray; parting into 5- to 18-inch layers; few stylolitic laminae; interbedded with cryptocrystalline, light-olive-gray to medium-light-gray, finely laminated, fissile to platy dolomite; quartz and calcite veins perpendicular to bedding.	13
Dolomite, medium-gray to medium-dark-gray, very finely crystalline and cryptocrystalline; weathers grayish orange to moderate yellowish brown and yellowish gray to light olive gray; parting into 2- to 6-inch layers; laminated; laminae containing silt and very fine-grained quartz sand in upper 1½ feet, abundant fine silty laminae in 2½-foot zone 1 foot from base; 1½-foot zone of disrupted laminae, flat pebble conglomerate and probably wave rippled laminae 1½ feet from base; 3-inch dolomitic quartzite ½ foot from base; disseminated pyrite; upper 2 feet platy.	6
Dolomite, medium-dark gray, very finely crystalline; weathers yellowish gray to light olive gray; parting into 4- to 17-inch layers; few stylolitic laminae; quartz and calcite veins perpendicular to bedding; gradational from underlying unit.	4
Dolomite, medium-dark-gray, cryptocrystalline; weathers olive gray; finely laminated; platy.	2
Dolomite, medium-dark-gray, very finely crystalline; weathers yellowish gray, grayish orange and light olive gray; parting into 2- to 9-inch layers; laminated in lower 6 feet with laminae decreasing upwards; quartz and calcite veins perpendicular to bedding.	9
Dolomite, dark gray, very finely crystalline; weathers light olive gray to yellowish gray; massive; some stylolitic laminae; quartz and calcite veins perpendicular to bedding; gradational from underlying unit.	8½
Dolomite, medium-gray to dark-gray, very finely crystalline to cryptocrystalline; weathers yellowish gray to moderate yellowish brown and medium dark gray to olive gray; laminae containing	

	Feet
silt, very fine-grained quartz sand, and some coarse-grained quartz sand; mud cracks; disseminated pyrite; fissile to platy.	5½
Covered.	5½
Dolomite, medium-gray to dark-gray, very finely crystalline to cryptocrystalline; weathers yellowish gray to moderate yellowish brown; parting into 1- to 8-inch layers; laminated; platy in part.	3
Limestone, medium-dark-gray, very finely crystalline; weathers light gray to medium light gray, disseminated grains, patches, and irregular laminae of dolomite; 3-inch lens of brownish-black chert 2 inches below top; gradational from underlying unit.	1½
Dolomite, medium-gray, to medium-dark-gray, very finely crystalline; weathers yellowish gray to grayish orange and moderate brown; parting into 1- to 9-inch layers; few laminae near top becoming abundant near base; laminae contain silty and very fine-grained quartz sand; lower 5 feet platy and contain disseminated pyrite.	7
Covered.	2–3
Dolomite, medium-gray to medium-dark-gray and light-brownish-gray to light-olive-gray, very finely crystalline; weathers yellowish gray to grayish orange; parting into 2- to 7-inch layers in upper 7 feet; lower 3 feet massive; few laminae in upper 7 feet.	10
Covered.	3
Dolomite, medium-light-gray to light-olive-gray, very finely crystalline; weathers grayish orange; parting into 1- to 5-inch layers; laminated; platy in part.	4
Covered.	13
Dolomite, medium-light-gray and pale-yellowish-brown, very finely crystalline to cryptocrystalline; weathers grayish orange and light brown to moderate yellowish brown; laminated throughout; laminae containing silty and very fine-grained quartz sand in lower 1 foot; mud cracks common. Argillaceous in part; disseminated pyrite; platy to fissile.	6½
Covered.	3
Dolomite, pale-yellowish-brown to light-olive-gray and medium-dark-gray, very finely crystalline; laminated; disseminated pyrite; platy to fissile.	1½
Dolomite, medium-gray to medium-dark-gray to light-brownish gray, very finely crystalline; weathers yellowish gray to grayish orange; lower 5½ feet laminated; 1 foot gradational zone of argillaceous, platy to fissile; moderate brown weathering dolomite 2 feet from base; few pyrite cubes weathered to limonite.	7½
Covered.	1–2
Dolomite, light-gray to light-olive-gray, very finely crystalline; weathers grayish orange and dark yellowish orange to light brown; abundant laminae and thin beds containing very fine-grained quartz sand; few mud cracks; strong cleavage laminae.	6½
Covered.	15
Dolomite, light-gray to medium-dark-gray, very finely crystalline; weathers grayish orange to moderate yellowish brown; parting into 2- to 7-inch layers; laminated.	3
Covered. Deeply weathered silty to argillaceous dolomite float.	4
Dolomite, medium-gray and medium-light-gray to light-olive-	

	Feet
gray, very finely crystalline; weathers grayish orange to light brown; laminated; few laminae containing very fine-grained quartz sand; platy.	6½
Covered. Dolomite float.	9
Dolomite, medium-gray, very finely crystalline; weathers yellowish gray.	1½
Covered.	½
Dolomite, light-gray to light-olive-gray, very finely crystalline; parting into 2- to 3-inch layers.	1
Covered.	2
Dolomite, yellowish-gray to pinkish-gray, very finely and finely crystalline; few laminae; quartz and calcite veins.	7
Covered.	4½
Dolomite, medium-gray to medium-dark-gray to light olive-gray; very finely crystalline; weathers grayish orange to light brown; laminated; disseminated pyrite cubes; platy to fissile in upper 11 feet; cleavage laminated.	13
Covered.	15
Dolomite, medium-gray to light-olive-gray, very finely crystalline; weathers grayish orange to moderate brown; laminated; few laminae containing silt and very fine-grained quartz sand; few mud cracks; disseminated pyrite; platy to fissile.	12½
Covered.	3
Limestone, medium-gray to medium-dark-gray, finely crystalline; weathers medium light gray.	1½
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers grayish orange to moderate brown and yellowish gray; parting into 1- to 4-inch layers; laminated except for 16-inch bed 6½ feet from base; abundant disseminated pyrite in some beds; possible minor bedding-plane-normal fault 4 feet from base.	3
In core of overturned fold. Core is not a simple flexure but is a complex of folding and minor faulting. Section following is east of the fold and minor normal fault. The beds are right side up.	
Limestone, very-light-gray to medium-light-gray, very finely crystalline; some stylolitic laminae; color streaked, a 3- to 5-inch irregular bed of yellowish gray weathering dolomite which is brecciated in places and veined with quartz and calcite occurs 1 to 2 feet from top; dolomite also occurs in disseminated grains and patches; gradational from underlying unit.	6½
Dolomite, light-gray, light-olive-gray and medium-light-gray, very finely to finely crystalline; weathers yellowish gray and grayish orange to moderate brown; parting into 2- to 14-inch layers; laminae and thin beds containing silt and very fine-grained quartz sand; some minor intraformational conglomerate; few cross-laminations; gradational from underlying unit.	24
Limestone, white to light-gray to grayish-pink, very finely to finely crystalline; weathers white to grayish pink; few distorted dolomite laminae at top; few quartzitic laminae near base; some stylolitic laminae; coarse calcite crystals in patches.	2
Dolomite, medium-light-gray to medium-gray, very finely to finely crystalline; weathers yellowish gray to grayish orange to	

	Feet
moderate brown; parting into 3- to 7-inch layers; laminae and beds containing silt and very fine-grained quartz sand; laminae most abundant at base with none at top.	6½
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers very light gray to medium gray; dolomite in distorted laminae, thin beds and patches; few stylolitic laminae; some patches of coarse calcite crystals; disseminated pyrite; gradational to overlying unit.	2
Dolomite, medium-dark-gray; very finely crystalline; weathers yellowish gray; parting into 2- to 8-inch layers; laminated on weathered surfaces; two 3-inch beds 1 foot and 1½ feet from base which weather earthy olive black; minor intraformational flat pebble conglomerate.	3
Limestone, medium-gray to medium-light-gray, very finely crystalline; weathers light gray to medium light gray; dolomite in disseminated grains and irregular fine laminae; some pinkish gray zones; disseminated coarse calcite crystals; gradational from underlying unit..	½
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish gray and grayish orange to moderate brown; parting into 5- to 12-inch layers; laminated except in upper 1 foot; abundant laminae and beds in lower part decreasing upward; laminae contain silt and very fine-grained quartz sand, indistinct ripple marks; few cross laminations, disseminated pyrite; gradational from underlying unit.	5
Limestone, medium-gray to medium-light-gray, very finely crystalline; weathers very light gray to medium light gray; dolomite in laminae, thin beds and patches mostly in upper ½ foot; nodular masses and lenses of coarse crystalline calcite; disseminated pyrite; gradational from underlying unit.	1½
Dolomite, medium-light-gray to medium-gray, very finely crystalline; weathers yellowish gray to grayish orange; parting into 2- to 18-inch layers; two 1- to 2-inch hard, dark-gray weathering, pyritic and quartzitic beds in lower ½ foot; 4-inch silty, laminated zone 1½ feet from base which is gradational upwards and downwards; gradational from underlying unit.	3½
Limestone, medium-dark-gray to dark-gray, very finely and finely crystalline; weathers medium gray to medium dark gray; anastomosing irregular dolomitic laminae and patches.	3½
Dolomite, medium-dark-gray, very finely crystalline; weathers yellowish gray to moderate yellowish brown; parting into 1- to 10-inch layers; laminated; stylolitic laminae containing hard dark shaly parting; few thin argillaceous and silty beds and one 1-foot bed near base; some cross-laminations; disseminated pyrite; gradational from underlying unit.	7½
Dolomite, medium-dark-gray, very finely crystalline; weathers pale yellowish brown to moderate yellowish brown; laminae and beds containing silt and very fine-grained quartz sand; grades to dark gray shale at top and bottom; abundant disseminated pyrite; platy to fissile; gradational from underlying unit.	3
Dolomite, medium-light-gray to dark-gray, very finely and finely crystalline; weathers grayish orange to moderate brown; parting	

	Feet
into 1- to 12-inch layers; laminae containing silt and very fine-grained quartz sand; few mud cracks; few thin zones of intraformational conglomerate; disseminated pyrite; mostly platy to fissile.	13½
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish gray to moderate brown; parting into 2- 12- inch layers; few laminae; hard shaly laminae separating most beds; 3-inch dark-gray shale bed 2½ feet from base; 15-inch bed at top contains thin pebble conglomerate zone and silt and very fine-grained quartz sand laminae; gradational from underlying unit.	5½
Limestone, very-light-gray, gray to medium-gray, very finely crystalline; weathers light gray to medium light gray; dolomite in disseminated grains; patches, stringers, and irregular laminae; abundant pebble conglomerate; stylolitic lower contact.	2
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish gray to grayish orange; parting into 1- to 15-inch layers; laminated; platy to fissile zone in middle.	5
Fault bearing N 75° E, 65° S. Probably a strike-slip fault. Correlation across fault unknown.	
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish gray to moderate brown and light olive gray; parting into 2- to 12-inch layers; mostly laminated; some cross-laminations; some 1- to 2-inch shale beds in lower 2½ feet; platy to fissile in part.	9
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers very pale orange to yellowish gray; faintly laminated in part; few stylolitic laminae; few minor conglomerate beds; laminae containing silt and very fine-grained quartz sand in ½ foot zone 2½ feet from base; calcite and quartz veins.	5½
Dolomite, medium-gray and medium-dark-gray to light-brownish-gray to light-olive-gray, very finely crystalline; weathers yellowish gray to moderate brown, parting into 1- to 8-inch layers; laminae and beds containing silt and very fine-grained quartz sand; some shale laminae and thin beds; few minor conglomeratic beds; some soft sediment deformation; mud cracks.	12
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish gray to very pale orange; massive; laminated in part; few thin zones of flat pebble conglomerate; few stylolitic laminae.	5½
Dolomite, light-gray to light-brownish-gray and medium-light-gray to medium-gray; very finely crystalline; weathers yellowish gray to moderate brown; parting into 2- to 12-inch layers; laminae and thin beds containing silt and very fine-grained quartz sand; few zones of cross-laminations; several zones of minor conglomerate; mud cracks.	12
Limestone, very-light-gray to medium-dark-gray, very finely crystalline; weathers very light gray to medium-dark-gray; abundant dolomite in patches, anastomosing stringers, and irregular laminae.	3
Dolomite, medium-light-gray to light-brownish-gray to light-	

	Feet
olive-gray, very finely crystalline; weathers grayish orange to light brown; parting into 2- to 8-inch layers; laminated; laminae containing silt and very fine-grained quartz sand become rarer upward.	3½
Dolomite, medium-gray and medium-dark-gray, very finely and finely crystalline; weathers very pale orange to yellowish gray; parting into 2-inch to 3-foot layers; mostly laminated; some stylolitic laminae; few zones of minor flat pebble conglomerate; ½-foot zone of lensing light-gray to medium-light-gray limestone containing dolomitic laminae occurs 1 foot from top; gradational from underlying unit.	7½
Limestone, medium-light-gray to medium-dark-gray, finely crystalline; weathers medium light gray to medium dark gray; dolomite in disseminated grains and patches.	1
Total	669–771

Section 5

Section located in quarries and in stream cut along Little Chickies Creek from 0.5 miles north of the Mount Joy City Hall to 0.4 miles north of the Mount Joy City Hall or from approximately 40°07′05″ N latitude and 76°30′10″ W longitude to 40°07′00″ N latitude and 76°30′05″ W longitude. The entire stratigraphic sequence is overturned.

(Measured by H. Meisler and A. Becher)

Lower Ordovician
Beekmantown Group
Epler Formation

	Feet
Limestone, medium-gray to dark-gray, very finely and finely crystalline; weathers light gray, medium gray and yellowish gray; parting into 1- to 5-inch layers; bedding laminae from very fine to 1-inch thick; some laminae undulating and anastomosing; some dolomitic laminae; several thin beds and stringers of gray chert up to 1½ inches thick in lower 17 feet and a few chert nodules 4 feet from top; crinoid stem plates in some beds; calcite in gash fractures and veins; most beds appear dolomitic on weathered surfaces but give strong reaction to dilute hydrochloric acid; many beds weather to a granular "salt and pepper texture."	50
Section continued southward along Little Chickies Creek based on calculation from bedding attitude. Correlation is uncertain.	
Limestone, medium-gray to medium-dark-gray, very finely and finely crystalline; weathers very light gray to light gray; parting into ½- to 3-inch layers; laminated; four zones of white and gray chert lenses ¼ to ½ inch thick; probably dolomitic limestone in part; few crinoid stem plates; weathers fissile to platy in part.	15
Covered.	4
Limestone, dark-gray, very finely crystalline; weathers medium light gray; parting into 1- to 2-inch layers in lower 1½ feet; massive in upper 2 feet.	3½

	Feet
Dolomite, medium-gray and dark-gray, very finely crystalline; shattered; veined with calcite and quartz.	4
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers light gray; contains a few silty laminae.	1
Dolomite, medium-light-gray and medium-dark-gray, very finely crystalline; shattered; veined with calcite and quartz.	4
Covered.	4
Dolomite, medium-dark-gray, very finely crystalline, shattered; veined with calcite and quartz.	1½
Covered.	½
Limestone, medium-dark-gray, cryptocrystalline to very finely crystalline; weathers very light gray; laminated.	1
Dolomite, medium-dark-gray, very finely crystalline; weathers white to very light gray; parting into 4- to 9-inch layers; faintly color laminated in lower 1½ feet; calcareous in upper 1½ feet.	3
Covered.	5–10
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers white to very light gray; parting into ½- to 1½-foot layers; a 4-inch lens of medium-gray mottled and streaked limestone located 3 feet from top; lower contact undulates as in boudinage.	6
Limestone, medium-gray to dark-gray, very finely crystalline; weathers very light to light gray; parting into 1- to 7-inch layers; contains a few fine laminae; platy in part.	2
Dolomite, medium-gray to medium-dark-gray, very finely crystalline, parting into 1 to 4 inch layers.	1
Limestone, dolomitic, medium-gray, very finely crystalline; weathers very light gray; parting into 2½- to 9-inch layers.	1½
Limestone, medium-dark-gray, very finely crystalline; weathers very light gray; laminated.	4½
Dolomite, calcareous, medium-dark-gray, very finely crystalline.	½
Limestone, medium-dark-gray, very finely and finely crystalline; weathers very light gray and light gray; laminated; dolomitic limestone in lower 4 inches.	2½
Covered.	2
Limestone, medium-gray and medium-dark-gray, very finely to finely crystalline; weathers very light gray to light gray; parting into 6- to 12-inch layers; finely laminated.	2½
Traverse 275 feet in S30° E direction across a covered area. Stratigraphic thickness unknown. Section continued in unused quarry.	
Limestone, medium-gray to medium-dark-gray, very finely crystalline.	½
Dolomite, medium-light-gray and medium-dark-gray, very finely crystalline; weathers light gray; parting into 4- to 7-inch layers; shattered; veined with calcite; boudinage.	3½
Limestone, medium-dark-gray, very finely crystalline; weathers light gray to medium light gray; cleavage laminated; pinches and swells.	1
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers very pale orange; boudinage.	1
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers very light gray to medium light gray; fine color laminae; pinches and swells.	1

	Feet
Dolomite, medium-dark-gray to dark-gray, very finely crystalline; weathers yellowish gray to light gray; faintly laminated; pinches and swells; shattered; veined with calcite and quartz.	1
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers very light gray to light gray; laminated; weathers ribbed; pinches and swells; grades downward into underlying unit.	1½
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; boudinage.	1½
Limestone, medium-light-gray and medium-gray, very finely crystalline; weathers very light gray to medium light gray; laminated; cleavage laminated; color streaked.	3
Dolomite, medium-dark-gray, very finely crystalline; weathers light gray; boudinage; shattered; calcite veined.	½
Limestone, medium-gray to medium-dark-gray; very finely crystalline; weathers light gray to medium gray; cleavage laminated; pinches and swells.	½
Dolomite, medium-gray, very finely crystalline; weathers very pale orange to yellowish gray; parting into 6- to 9-inch layers; boudinage; shattered; veined with calcite and quartz.	1½
Limestone, medium-dark-gray to dark-gray, very finely crystalline; weathers light gray to medium light gray; laminated.	1
Dolomite, medium-gray to medium-dark-gray, very finely to finely crystalline; weathers light gray to yellowish gray; parting into 8- to 15-inch layers; gradational into underlying unit.	4
Limestone, medium-gray to medium-dark-gray, very finely to finely crystalline; weathers light gray to medium light gray; some dolomitic limestone laminae and zones in lower 1½ feet; cleavage laminated.	3½
Dolomite, medium-dark-gray to dark-gray, very finely and finely crystalline; weathers very light gray to yellowish gray; parting into 1½- to 2-foot layers; calcareous dolomite in upper 1 foot.	5½
Dolomite, medium-dark-gray and dark-gray, very finely crystalline; weathers light gray; parting into 2- to 6-inch layers; laminated.	2½
Covered.	1
Limestone, medium-gray to medium-dark-gray, very finely to medium-crystalline; weathers light gray; parting into 2- to 7-inch layers; cleavage laminated.	1½
Limestone, medium-gray to medium-dark-gray, cryptocrystalline to very finely crystalline; weathers light gray; massive; laminated; some dolomitic limestone laminae.	2½
Dolomite, medium-dark-gray, very finely crystalline; weathers very light gray to yellowish gray; parting into 2- to 12-inch layers; an 8-inch laminated bed located 1 foot from top; calcareous dolomite in lower ½ foot; boudinage.	5½
Limestone, medium-gray, very finely crystalline; weathers light gray; laminated; pinches and swells.	1
Dolomite, medium-gray to dark-gray, very finely crystalline; weathers light gray to yellowish gray; parting into 15- to 18-inch layers; boudinage.	2
Limestone, medium-gray to medium-dark-gray, very finely crys-	

	Feet
talline; weathers very light gray to medium gray; massive; cleavage laminated; laminated dolomitic limestone in upper 4 inches; pinches and swells.	3
Dolomite, medium-gray to medium-dark-gray; very finely crystalline; weathers light gray to yellowish gray; boudinage; veined with calcite and quartz.	1
Limestone, medium-dark-gray, very finely crystalline; weathers light gray to light olive gray; indistinct cleavage laminae.	1½
Dolomite, calcareous, medium-dark-gray, very finely crystalline; weathers yellowish gray; contains disrupted limestone laminae; boudinage.	½
Limestone, medium-gray and medium-dark-gray, very finely crystalline; weathers light gray; parting into 1- to 12-inch layers; color laminated; appears to be dolomitic in part; pinches and swells.	2
Dolomite, medium-gray and medium-dark-gray, very finely and finely crystalline; weathers medium light gray; parting into 4- to 14-inch layers.	7
Dolomite, calcareous, medium-dark-gray, very finely crystalline; weathers light gray; parting into 6- to 14-inch layers; contains limestone laminae.	2½
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers light gray; parting into 2- to 5-inch layers; color laminated.	½
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers light gray to light olive gray; boudinage; shattered.	1½
Limestone, medium-dark-gray, very finely crystalline; weathers very light gray; parting into 1- to 8-inch layers; color laminated in upper 1 foot; 6-inch bed of medium-gray dolomitic limestone located 4 inches from top; pinches and swells.	2
Dolomite, medium-dark-gray, very finely crystalline; weathers light gray; some limestone mottles; boudinage.	1
Limestone, medium-gray and medium-dark-gray, very finely crystalline; weathers very light gray and light gray; cleavage laminated; pinches and swells.	1½
Limestone, medium-dark-gray, very finely crystalline; weathers light gray and medium light gray; parting into 3- to 15-inch layers; abundant dolomite laminae and blebs.	6
Dolomite, calcareous, medium-dark-gray to dark-gray, very finely crystalline; shattered.	1
Limestone, medium-dark-gray to dark-gray, very finely crystalline; weathers light gray to medium light gray; finely laminated; cleavage laminated.	2
Dolomite, medium-dark-gray, very finely crystalline; shattered; veined with calcite.	1

Section 6

Section in quarry (northeasternmost of two adjacent quarries) located 0.2 miles north f Little Chiques Park, Mount Joy, Pa. and extending southward along Little Chickies 'reek to the Pennsylvania Railroad bridge across Little Chickies Creek in Mount Joy; or

from approximately 40°07′05″ N latitude and 76°29′30″ W longitude to 40°06′30″ N latitude and 76°29′25″ W longitude. This section is stratigraphically below section 5. The entire stratigraphic sequence is overturned.

(Measured by H. Meisler and A. Becher)

Lower Ordovician
Beekmantown Group
Epler Formation

	Feet
Dolomite, medium-gray, very finely crystalline; weathers yellowish gray; parting into 1- to 3-foot layers; irregular mass of dark-gray limestone in upper 2 feet; veined with calcite and quartz.	6½
Dolomite, medium-dark-gray, very finely crystalline; weathers yellowish gray; parting into 5- to 18-inch layers; veined with calcite.	6½
Limestone, medium-dark-gray to dark-gray, very finely to finely crystalline; weathers medium gray; parting into 2- to 5-inch layers; dolomite blebs in upper 1 foot; fossil detritus in ½-foot zone located ½ foot from top.	1½
Dolomite, medium-dark-gray to dark-gray, very finely crystalline; weathers yellowish gray; faint laminae in lower 2 inches.	1½
Limestone, medium-dark-gray, very finely crystalline; weathers medium light gray; dolomite laminae and thin interbeds in lower 10 inches; mud cracks on lower surface.	2
Dolomite, medium-dark-gray, very finely to finely crystalline; weathers yellowish gray; parting into ½- to 2-foot layers; ½-foot bed of pinching and swelling medium-dark-gray limestone located ½ foot from base; few 2-inch layers of shattered dolomite; veined with calcite and quartz.	5½
Dolomite, medium-dark-gray to dark-gray, very finely crystalline; weathers yellowish gray.	3
Limestone, medium-dark-gray; weathers medium light gray.	1½
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers very light gray to yellowish gray; parting into 6- to 12-inch layers; finely laminated in part; veined with calcite.	6
Limestone, medium-gray to medium-dark-gray, cryptocrystalline to very finely crystalline; weathers very light gray.	½
Dolomite, medium-gray and medium-dark-gray, very finely and finely crystalline; weathers yellowish gray to very light gray; parting into 2- to 12-inch layers; finely laminated in part; limestone blebs in a 5-inch bed located 2 feet below top.	9
Limestone, medium-dark-gray, very finely to finely crystalline; weathers medium light gray; abundant dolomite laminae.	½
Dolomite, medium-gray and medium-dark-gray, very finely to finely crystalline; weathers yellowish gray to very light gray; parting into 1- to 9-inch layers; few limestone laminae in ½-foot zone located 1½ feet below top; veined with calcite.	5
Limestone, dolomitic, medium-dark-gray to dark-gray; very finely crystalline; weathers light gray; wavy laminae; platy in part.	½
Dolomite, medium-dark-gray, very finely crystalline; weathers light gray; limestone laminae in upper 1 inch.	1

	Feet
Dolomite, medium-gray and medium-dark-gray, very finely and finely crystalline; weathers very light gray and yellowish gray; parting into 4- to 12-inch layers; finely color laminated; 3-inch medium-gray limestone at top.	4
Interlaminated limestone and dolomite, medium-gray and medium-dark-gray, very finely and finely crystalline; dolomite weathers very light gray; limestone weathers light gray; parting into 2- to 14-inch layers; wavy laminae up to ½ inch thick.	2½
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish gray; finely laminated; veined with calcite.	2
Limestone, medium-dark-gray, very finely crystalline; weathers light gray; abundant dolomite laminae and blebs.	1½
Dolomite, medium-dark-gray, very finely crystalline; weathers yellowish gray; parting into 5- to 7-inch layers; laminated in part; upper ½ foot contains limestone and is gradational from overlying unit.	4
Covered.	2
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers medium gray; parting into 4- to 15-inch layers; finely laminated.	2
Dolomite, medium-gray to medium-dark-gray, very finely to finely crystalline; weathers yellowish gray; parting into 3- to 8-inch layers; pinches and swells; veined with calcite.	1½
Limestone, medium-dark-gray, very finely crystalline; weathers medium light gray; abundant light-olive-gray dolomitic laminae; pinches and swells.	1
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish gray; shattered; veined with calcite.	1½
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers very light gray to light gray.	½
Dolomite, calcareous, medium-dark-gray to dark-gray, very finely crystalline; shattered; veined with calcite; pinches and swells.	1
Limestone, medium-dark-gray, very finely crystalline; weathers light gray to medium light gray; parting into 2- to 9-inch layers; cleavage laminated; a 1½-foot zone containing dolomitic laminae and blebs located ½ foot from top; calcite veins in ½-foot zone located ½ foot from top.	3
Limestone, medium-dark-gray to dark-gray, very finely crystalline; weathers light gray to medium light gray; abundant irregular masses of dolomite.	1½
Dolomite, medium-dark-gray, very finely crystalline; weathers light gray; parting into 5- to 16-inch layers; shattered.	2
Traversed 700 feet in S45°W direction across a covered area. Stratigraphic thickness unknown.	
Limestone, medium-dark-gray to dark-gray, very finely crystalline; weathers light gray to medium light gray; parting into 5- to 16-inch layers; dolomitic laminae; cleavage laminated.	2½
Covered.	1
Dolomite, medium-dark-gray to dark-gray, very finely crystalline; weathers yellowish gray; parting into ½- and 1½-foot layers.	2

	Feet
Covered.	3
Limestone, medium-dark-gray, very finely crystalline; weathers medium gray and yellowish gray; parting into 2- to 18-inch layers; laminated; abundant dolomitic laminae.	5½
Dolomite, calcareous, dark-gray, very finely crystalline; weathers yellowish gray; parting into ½- to 1-foot layers; boudinage; shattered; calcite veined.	2
Limestone, medium-dark-gray, very finely crystalline; weathers light gray to medium light gray; parting into 2- to 15-inch layers; cleavage laminated.	3
Dolomite, medium-dark-gray, very finely crystalline; weathers yellowish gray; shattered; veined with calcite.	½
Limestone, medium-dark-gray to dark-gray, very finely crystalline; weathers medium light gray; finely laminated.	2
Dolomite, medium-dark-gray, very finely to finely crystalline; weathers yellowish gray; boudinage; shattered; calcite veined.	1½
Limestone, medium-dark-gray, very finely crystalline; weathers medium light gray to medium gray; parting into 2- to 8-inch layers; ½-foot bed containing abundant dolomite blebs located ½ foot from top.	4
Dolomite, calcareous, medium-gray, very finely crystalline; weathers yellowish gray; boudinage.	½
Limestone, medium-dark-gray, very finely crystalline; weathers very light gray to light gray; parting into 4- to 8-inch layers; dolomite laminae in upper 1 foot; cleavage laminated.	4½
Dolomite, medium-gray to medium-dark-gray, very finely to finely crystalline; weathers yellowish gray; boudinage.	1
Limestone, medium-dark-gray, very finely crystalline; weathers medium light gray; massive; strongly laminated; dolomitic limestone laminae; platy.	3½
Covered.	2
Dolomite, medium-gray and medium-dark-gray; very finely to finely crystalline; weathers yellowish gray; parting into ½- to 1-foot layers; faint laminae in lower 1 foot; boudinage; shattered; veined with calcite.	4
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers light gray; laminated; pinches and swells.	1
Dolomite, calcareous, medium-gray, very finely crystalline; weathers yellowish gray to very light gray; boudinage.	1
Limestone, medium-light-gray to medium-dark-gray, very finely crystalline; weathers light gray to medium gray; cleavage laminated; pinches and swells.	2
Dolomite, medium-light-gray, very finely crystalline; weathers very light gray; calcareous in lower 3 inches; boudinage; veined with calcite.	3
Traverse 37 feet in S20°E direction across covered area. Stratigraphic thickness unknown.	
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers light gray; massive; shattered; veined with calcite and quartz.	3
Limestone, medium-dark-gray to dark-gray, very finely to finely crystalline; color laminated.	½

	Feet
Dolomite, medium-dark-gray to dark-gray, very finely crystalline; veined with calcite.	1
Limestone, medium-dark-gray, very finely crystalline; weathers medium light gray; laminated.	½
Dolomite, medium-dark-gray to dark-gray, very finely crystalline; parting into 4- to 7-inch layers; boudinage; veined with calcite and quartz.	4½
Traverse 65 feet in S45°E direction across covered area. Stratigraphic thickness unknown.	
Dolomite, medium-gray, very finely to finely crystalline; weathers yellowish gray; faintly laminated in part; veined with calcite.	1½
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers light gray; parting into 3-inch to 2½-foot layers; ½-foot bed of dolomitic limestone ½ foot below top; cleavage laminated.	5½
Dolomite, calcareous, medium-gray, very finely to finely crystalline; weathers very light gray to light gray; faint irregular cleavage laminae; pinches and swells.	1
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers very light gray to light gray; cleavage laminated; pinches and swells.	1
Dolomite, calcareous, medium-dark-gray, very finely crystalline; weathers very light gray to light gray; boudinage.	1
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers very light gray to light gray; parting into 3- to 6-inch layers; cleavage laminated; pinches and swells.	3
Dolomite, medium-gray to medium-dark-gray, very finely crystalline; weathers yellowish gray; boudinage; veined with calcite and quartz.	1½
Limestone, medium-dark-gray, very finely to finely crystalline; weathers very light gray to light gray; parting into 2- to 12-inch layers; cleavage laminated; pinches and swells.	3
Section continued by correlation across a 20 foot break in the outcrop.	
Dolomite, medium-dark-gray, very finely to finely crystalline; pinching and swelling.	1
Limestone, medium-dark-gray, very finely to finely crystalline; weathers light gray to medium light gray; parting into 2- to 8-inch layers; cleavage laminated; pinches and swells.	3½
Dolomite, dark-gray, very finely crystalline; weathers light gray; boudinage.	1½
Limestone, medium-dark-gray to dark-gray, very finely crystalline; weathers very light gray to medium light gray; dolomitic limestone in part; cleavage laminated; pinches and swells.	4
Covered.	1
Limestone, medium-dark-gray and very-light-gray to light-olive-gray, very finely crystalline; weathers light gray to medium light gray; parting into 8-inch and 3-foot layers; color laminated; some dolomite laminae in lower 1 foot.	4
Dolomite, medium-dark-gray, very finely crystalline; boudinage.	1
Covered.	2
Dolomite, medium-dark-gray to dark-gray, very finely to finely	

	Feet
crystalline; weathers light gray to yellowish gray; veined with calcite.	1½
Traverse 22 feet in S50°E direction across break in outcrop. Estimated covered interval.	5–10
Limestone, medium-gray to dark-gray, very finely to finely crystalline; weathers very light gray to light gray; some bedding laminae; cleavage laminated; few crinoid stem plates.	17
Dolomite, medium-dark-gray to dark-gray, very finely crystalline; weathers light gray to yellowish gray; boudinage.	1½
Limestone, medium-light-gray to medium-dark-gray, very finely to finely crystalline; weathers very light gray to light gray; color laminae; cleavage laminated.	7
Dolomite, medium-gray to medium-dark-gray; finely crystalline; weathers light gray to yellowish gray; parting into 7- to 12-inch layers; boudinage.	3
Limestone, medium-gray and medium-dark-gray, very finely to finely crystalline; weathers very light gray to light gray; fine bedding laminae in lower ½ foot; cleavage laminated.	5
Limestone, medium-dark-gray, very finely crystalline; weathers light gray and yellowish gray; abundant dolomitic limestone blebs and distorted laminae.	2
Dolomite, calcareous, medium-dark-gray, very finely crystalline; weathers light gray to light olive gray; limestone blebs in lower 2 inches.	1
Limestone, medium-dark-gray, very finely crystalline; weathers very light gray to light gray; some bedding laminae; cleavage laminated; pinches and swells.	3
Dolomite, medium-gray to medium-dark-gray, very finely to finely crystalline; weathers light gray to light-olive gray; boudinage; shattered; veined with calcite and quartz.	1
Limestone, medium-dark-gray, very finely to finely crystalline; weathers light gray; fine bedding laminae; pinches and swells.	1
Dolomite, medium-dark-gray, finely crystalline; boudinage; shattered.	1
Limestone, medium-dark-gray, very finely to finely crystalline; weathers light gray; fine bedding laminae.	4
Dolomite, medium-dark-gray, very finely to finely crystalline; weathers yellowish gray to light olive gray; faint laminae; pinches and swells.	1
Section continued by correlation across a covered area.	
Dolomite, medium-dark-gray, very finely to finely crystalline; weathers light gray to yellowish gray; parting into 3- to 6-inch layers; faintly laminated in part.	3
Covered.	4
Dolomote, medium-dark-gray, very finely crystalline; weathers yellowish gray to light olive gray and light gray; parting into 2- to 3-inch layers; some faint laminae.	2½
Break in outcrop. Stratigraphic thickness of covered interval unknown.	
Limestone, medium-gray to medium-dark-gray, very finely to finely crystalline; weathers light gray; few bedding laminae; cleavage laminated; some fossil detritus and crinoid stem plates.	7

	Feet
Traverse 270 feet in S50°E direction across covered area. Stratigraphic thickness unknown.	
Limestone, medium-dark-gray, very finely crystalline; weathers light gray; parting into 2- to 7-inch layers; some bedding laminae; well developed cleavage laminae; argillaceous in lower 1½ feet.	4½
Covered interval containing a few thin layers of argillaceous limestone.	3
Limestone, medium-gray, medium-dark-gray, and pale-yellowish-brown, very finely crystalline; weathers light gray and very pale orange to grayish orange; fine argillaceous anastomosing laminae; well developed cleavage laminae; few crinoid stem plates.	11
Limestone, argillaceous, medium-gray to light-olive-gray, very finely crystalline; weathers very pale orange to grayish orange; parting into ½- to 2-inch layers; laminated; fissile to platy.	3
Limestone, medium-dark-gray, very finely crystalline; weathers light gray; fine dark-gray weathering shale laminae; abundant medium-grained calcite on some weathered surfaces; few crinoid plates.	1
Dolomite, medium-dark-gray, very finely to finely crystalline; pinching and swelling; veined with calcite and quartz.	1½
Limestone, medium-dark-gray, very finely to finely crystalline; weathers very light gray to light gray; laminated; cleavage laminated; abundant fossil detritus; crinoid stem plates common near top.	7
Covered.	1
Limestone, medium-light-gray to medium-dark-gray, very finely crystalline; weathers very light gray to light gray; abundant fine shaly laminae; cleavage laminated.	3½
Covered.	2
Limestone, medium-light-gray to medium-dark-gray; very finely to finely crystalline; weathers light gray; abundant shaly laminae; well developed cleavage laminae; fossil detritus common; crinoid stem plates.	19
Covered.	4
Limestone, medium-dark-gray, very finely to finely crystalline; weathers light gray; some fine shaly laminae; strong cleavage laminae.	4½
Covered.	½
Limestone, very finely to finely crystalline; weathers light gray to medium light gray; parting into 5- to 12-inch layers; cleavage laminated; some fossil detritus.	2½
Covered.	1
Limestone, medium-dark-gray, very finely crystalline; weathers light gray; some shaly laminae; strong cleavage laminae.	4
Covered.	2
Limestone, medium-gray to medium-dark-gray, finely crystalline; weathers light gray; few shaly laminae.	3
Limestone, dolomitic, medium-gray to medium-dark-gray, very finely to finely crystalline; weathers pale yellowish brown to light olive gray; faintly laminated; veined with calcite and quartz.	1

	Feet
Limestone, medium-dark-gray, very finely to finely crystalline; weathers light gray; cleavage laminated; abundant coarse grained calcite in some beds; veined with calcite and quartz.	10
Covered.	1
Limestone, medium-dark-gray, very finely and finely crystalline; weathers light gray; well developed cleavage laminae; abundant fossil detritus; some crinoid stem plates; veined with calcite and quartz.	6
Traverse 60 feet in south direction across covered area. Stratigraphic thickness unknown.	
Limestone, medium-dark-gray, very finely crystalline; weathers light gray to medium light gray; some bedding laminae; lower 1 foot fissile to platy.	4
Covered.	1½
Limestone, medium-dark-gray to dark-gray, very finely crystalline; weathers light gray to medium light gray; distinct cleavage laminae.	2½
Limestone, light-gray to light-brownish-gray and very pale orange, very finely crystalline; weathers light gray to pinkish gray; cleavage laminatcd.	4
Covered.	2
Limestone, very-light-gray to light-brownish-gray, cryptocrystalline to very finely crystalline; weathers very light gray to grayish pink and very pale orange; parting into 1- to 8-inch layers; some fine color laminae; cleavage laminated.	14
Dolomite, light-gray, very finely crystalline; weathers very light gray to yellowish gray; faintly laminated in part; pinches and swells; veined with quartz.	½
Limestone, very-light-gray to light-brownish-gray, very finely crystalline; weathers very light gray to light gray; cleavage laminated.	5
Covered.	1
Limestone, pinkish-gray, very finely crystalline; weathers very light gray to pinkish gray; cleavage laminated.	1
Dolomite, light-gray, very finely crystalline; shattered, veined with quartz.	½
Limestone, very-light-gray to grayish-pink, cryptocrystalline to very finely crystalline; weathers very light gray; ½-foot bed of dolomitic limestone near middle.	3
Dolomite, very-light-gray to light-gray, cryptocrystalline to very finely crystalline; veined with quartz.	½
Limestone, very-light-gray to grayish-pink, very finely crystalline; weathers very light gray; distinct cleavage laminae.	1
Dolomite, medium-light-gray, very finely crystalline; shattered; veined with calcite and quartz.	1
Limestone, very-light-gray to pinkish-gray to very-pale-orange, very finely crystalline; weathers very light gray to pinkish gray; cleavage laminated.	6½
Dolomite, calcareous, very-light gray to pale-orange, cryptocrystalline to very finely crystalline; weathers yellowish gray; boudinage; veined with calcite and quartz.	½
Limestone, very-light-gray to very pale-orange, very finely crystal-	

	Feet
line; weathers very light gray; cleavage laminated; pinches and swells.	1
Dolomite, light-gray to medium-light-gray, very finely crystalline; weathers yellowish gray; finely laminated; boudinage; veined with quartz.	½
Limestone, very-light-gray to light-brownish-gray and very-pale-orange; cryptocrystalline to very finely crystalline; weathers very light gray; cleavage laminated.	4
Covered.	1
Limestone, medium-light-gray to medium-dark-gray, and finely crystalline; weathers very light gray; cleavage laminated; pinches and swells; medium-grained quartz sand in some beds.	5
Dolomite, medium-gray, very finely to finely crystalline; weathers light gray to yellowish gray; boudinage; shattered; veined with calcite and quartz.	2
Limestone, medium-dark-gray, very finely crystalline; weathers light gray to medium light gray; medium-grained calcite sand on weathered surface; cleavage laminated.	1½
Limestone, very-light-gray to very-pale-orange, very finely crystalline; weathers very light gray to pinkish gray; cleavage laminated.	3½
The following beds are adjacent to or in the core (axial plane) of an isoclinical overturned anticline. Axial plane N75°E, 45°S. Stratigraphic thickness is highly distorted.	
Limestone, medium-gray, very finely crystalline; weathers very light gray; cleavage laminated.	1
Dolomite, calcareous, medium-gray, very finely crystalline; weathers very light gray; parting into 2- to 4-inch layers.	1½
Dolomite, medium-gray to medium-dark-gray, finely crystalline; weathers yellowish gray to light gray; parting into 4- to 12-inch layers; few faint laminae; veined with calcite and quartz.	5
Section continued on south flank of syncline which is adjacent to the anticline described above.	
Limestone, medium-light-gray to medium-dark-gray, very finely crystalline; weathers very light gray to light gray; cleavage laminated; medium-grained calcite sand on some weathered surfaces.	12
Covered.	½
Dolomite, dark-gray, very finely crystalline; weathers yellowish gray; veined with calcite and quartz.	1
Limestone, medium-light-gray and medium-dark-gray, very finely crystalline; weathers light gray to medium light gray; cleavage laminated.	1½
Dolomite, medium-gray, very finely crystalline; weathers very light gray to light gray; boudinage; veined with calcite and quartz.	1
Limestone, light-gray and pinkish-gray, very finely crystalline; weathers very light gray to pinkish gray; cleavage laminated.	3
Dolomite, calcareous, medium-light-gray, very finely crystalline; weathers very light gray to light gray; some faint bedding laminae.	1
Limestone, light-gray to medium-light-gray and pinkish-gray to	

	Feet
light-brownish-gray, very finely crystalline; weathers very light gray to light gray; medium-grained calcite sand on some weathered surfaces; cleavage laminated.	6
Dolomite, medium-light-gray, very finely crystalline; weathers yellowish gray; shattered; veined with quartz.	½
Covered.	3
Limestone, very-light-gray to pinkish-gray, very finely crystalline; weathers very light gray to pinkish gray; cleavage laminated.	6
Section continued on the basis of correlation.	
Dolomite, light-gray, very finely crystalline; weathers yellowish gray; finely laminated; veined with calcite and quartz.	3½
Limestone, light-gray to light-brownish-gray, very finely crystalline; weathers very light gray to light gray; cleavage laminated.	2½
Covered.	2
Limestone, very-light-gray to pinkish-gray to very-pale-orange, very finely crystalline; cleavage laminated.	2½
Dolomite, light-gray to medium-light-gray and pinkish-gray to light-brownish gray, very finely crystalline; weathers yellowish gray and very pale orange; laminated in part; veined with calcite and quartz.	7
Traverse approximately 800 feet in S30°W direction across covered area. Stratigraphic thickness unknown.	
Limestone, medium-dark-gray, very finely crystalline; weathers light gray; cleavage laminated.	3½
Covered.	2
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers very light gray to light gray; cleavage laminated.	4
Covered.	2
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers light gray; cleavage laminated.	1
Traverse 100 feet in S65°E direction across a covered area. Stratigraphic thickness unknown.	
Limestone, medium-dark-gray, medium- to coarsely crystalline; weathers earthy; parting into 1- to 7-inch layers; some floating rounded quartz and calcite grains.	2½
Limestone, medium-gray to medium-dark-gray, finely crystalline; weathers light gray and medium gray; parting into ¼- to 1-inch layers; bedding laminae in part; veined with calcite and quartz.	2½
Covered.	20–25
Limestone, medium-gray to medium-dark-gray, very finely crystalline; weathers light gray; cleavage laminated.	½
Limestone, medium-dark-gray, finely to very coarsely crystalline; weathers light gray to medium light gray; abundant silty laminae up to ½ inch thick; some dark gray shale laminae; cleavage laminated; abundant fossil detritus and crinoid stem plates in some layers.	4
Covered.	3
Limestone, medium-dark-gray, very finely to very coarsely crystalline; fossil detritus and crinoid stem plates.	1½
Covered.	1½
Limestone, medium-gray to medium-dark-gray, finely to coarsely	

	Feet
crystalline; weathers light gray and medium light gray; calcarenite containing abundant fossil detritus and crinoid stem plates; veined with calcite and quartz.	2½
Limestone, medium-dark-gray, very finely crystalline; weathers very light gray to light gray; some very fine anastomosing dark-gray shale laminae; black carbonaceous masses; pinches and swells; veined with calcite and quartz.	6
Dolomite, medium-gray, very finely to finely crystalline; weathers yellowish gray; boudinage; veined with calcite and quartz.	1
Limestone, medium-gray to light-brownish-gray, very finely crystalline; weathers very light gray to yellowish gray; cleavage laminated; platy.	½
Limestone, medium-dark-gray, very finely crystalline; weathers very light gray; cleavage laminated; abundant very coarse-grained calcite sand on weathered surface.	1
Dolomite, medium-gray, cryptocrystalline to very finely crystalline; weathers yellowish gray; boudinage; veined with calcite and quartz.	½
Limestone, light-gray to medium-gray, very finely to finely crystalline; weathers very light gray to light gray; cleavage laminated; pinches and swells.	1½
Dolomite, medium-gray to medium-dark-gray, very finely to finely crystalline; weathers yellowish gray to grayish orange; veined with calcite and quartz.	1
Covered.	3
Limestone, medium-dark-gray, very finely to finely crystalline; cleavage laminated.	2½
Limestone, medium-dark-gray to dark-gray, very finely to finely crystalline; weathers medium light gray to medium gray; a 2½-inch light gray chert lens located 2 feet from base.	6½
Dolomite, calcareous, medium-dark-gray, very finely crystalline; weathers yellowish gray; shattered.	½
Limestone, medium-dark-gray, very finely crystalline; weathers light gray to medium dark gray; color laminated; weathers earthy in upper ½ foot.	2
Covered.	7
Dolomite, medium-gray, very finely crystalline; shattered; veined with calcite and quartz.	2
Limestone, medium-gray to dark-gray, very finely crystalline; weathers light gray to medium light gray; upper ½ foot weathers very pale orange to yellowish gray and is deeply weathered; cleavage laminated; pinches and swells.	1½
Dolomite, light-olive-gray, very finely crystalline; weathers yellowish gray; pinches and swells; shattered; veined with calcite and quartz.	1½
Limestone, medium-dark-gray to dark-gray, very finely crystalline; weathers light gray to medium light gray; yellowish gray weathering bedding laminae; cleavage laminated; some coarse-grained calcite sand on weathered surface; some thin calcite veins parallel to cleavage and bedding.	7½
Covered.	3
Limestone, medium-gray and medium-dark-gray, very finely crys-	

	Feet
talline; weathers light gray to medium light gray; some yellowish gray weathering bedding laminae; cleavage laminated.	3½
Covered.	2
Limestone, very-light-gray to light-brownish-gray, very finely crystalline; weathers very light gray to pinkish gray; color laminated; cleavage laminated.	1½
Dolomite, very-pale-orange, very finely crystalline; color laminated.	1
Section continued along the edge of Little Chickies Creek on the basis of correlation.	
Limestone, light-gray and very-light-gray to pinkish-gray, very finely crystalline; weathers very light gray to light gray with pinkish-gray laminae; anastomosing color laminae; cleavage laminated; medium-dark-gray limestone in lower 3 inches; few gray chert nodules in lower ½ foot.	6½
Dolomite, medium-dark-gray, very finely crystalline; weathers yellowish gray; boudinage; shattered; veined with calcite and quartz.	½
Limestone, light-gray, very finely crystalline; weathers very light gray; medium-dark-gray limestone in upper ½ foot.	1½
Dolomite, calcareous, very-light-gray to pinkish-gray, very finely crystalline; weathers yellowish gray; boudinage; shattered; veined with calcite and quartz.	1
Limestone, very-light-gray to light-gray to pinkish gray, very finely crystalline; weathers very light gray to light gray; cleavage laminated; pinches and swells.	3
Dolomite, light-gray to pinkish-gray, very finely crystalline; weathers yellowish gray; parting into 1- to 8-inch layers; fine-bedding laminae in part; shattered; veined with calcite and quartz.	8
Limestone, very-light-gray, very finely crystalline; cleavage laminated.	1
Covered.	½
Dolomite, medium-gray, very finely crystalline; weathers light olive gray; shattered; veined with calcite and quartz.	½
Limestone, very-light-gray to light-brownish-gray, very finely crystalline; weathers very light gray to pinkish gray; orange streaks in cleavage laminae; veined with calcite.	2½
Dolomite, light-gray to pinkish-gray, cryptocrystalline to very finely crystalline; weathers very pale orange; some faint color laminae; some limestone laminae; cleavage laminated and platy in lower 1½ feet; veined with calcite and quartz; gradational into overlying unit.	3
Limestone, very-light-gray and light-gray, very finely crystalline; few color laminae; cleavage laminated.	4½
Dolomite, light-gray to medium-light-gray, cryptocrystalline to very finely crystalline; weathers light olive gray; veined with calcite and quartz.	1
Limestone, light-gray to medium-gray, very finely crystalline; weathers very light gray to light gray; cleavage laminated.	4½
Limestone, dolomitic, very-pale-orange, cryptocrystalline to very finely crystalline; cleavage laminated.	½
Covered.	4

	Feet
Limestone, white to very-pale-orange to pale-yellowish-brown, very finely crystalline; weathers very light gray; some color laminae; cleavage laminated; platy in part.	7
Dolomite, calcareous, light-gray to pinkish-gray, cryptocrystalline to very finely crystalline; weathers yellowish gray; faint color laminae; pinches and swells; veined with calcite and quartz.	½
Limestone, very-light-gray to light-brownish-gray, very finely crystalline; weathers white to very light gray; cleavage laminated; orange streaks in cleavage laminae.	3
Dolomite, light-gray, very finely crystalline; weathers yellowish gray; color laminae in part.	2
Limestone, light-gray to pinkish-gray, very finely to finely crystalline; cleavage laminated; platy in lower ½ foot.	1½
Traverse 30 feet eastward to small quarry.	
Estimated covered interval.	10–15
Limestone, very-pale-orange, yellowish-gray, and very-light-gray, very finely to finely crystalline; weathers light gray and very light gray to pinkish gray; dolomitic limestone in part; cleavage laminated; some orange streaks in cleavage laminae; platy in part.	14
Traverse 340 feet in S25°E direction across covered area. Stratigraphic thickness unknown.	
Limestone, very-light-gray to light-gray, very finely crystalline; weathers yellowish gray; massive; cleavage laminated; orange streaks in cleavage laminae.	2½
Limestone, dolomitic, very-pale-orange and light-gray to medium-light-gray, cryptocrystalline to very finely crystalline; weathers yellowish gray; parting into ½- to 1-inch layers; some faint bedding laminae.	1½
Limestone, pinkish-gray to light-brownish-gray, very finely crystalline; weathers light gray to medium light gray and very pale orange; some bedding laminae; cleavage laminated; orange streaks in cleavage laminae.	1½
Dolomite, light-gray to medium-light-gray, very finely crystalline; weathers yellowish gray; parting into 6- to 10-inch layers; veined with calcite and quartz	3
Limestone, very-light-gray to light-gray and pinkish-gray, very finely crystalline; weathers pinkish gray to very pale orange; parting into ¼- to 1-inch layers; bedding laminated; dolomitic limestone in part.	1½
Limestone, very-light-gray to pinkish-gray, very finely crystalline; weathers very light gray to light gray; cleavage laminated; orange streaks in cleavage laminae; pinches and swells.	1
Dolomite, very-pale-orange, cryptocrystalline to very finely crystalline; weathers yellowish gray to light gray; parting into 4- to 6-inch layers; fine bedding laminae; veined with calcite and quartz.	2½
Limestone, very-light-gray to light-gray, very finely crystalline; weathers very light gray to light gray; cleavage laminated.	½
Dolomite, very-light-gray to pinkish-gray, very finely crystalline; weathers light gray to yellowish gray.	½

	Feet
Limestone, very-light-gray to light-gray, very finely crystalline; weathers very light gray to light gray; cleavage laminated; some orange streaks in cleavage laminae; pinches and swells.	1
Dolomite, light-gray, very finely crystalline; weathers light gray; boudinage; veined with calcite and quartz.	1½
Covered.	3
Limestone, very-light-gray to light-gray, very finely crystalline; weathers very light gray; cleavage laminated; some orange streaks in cleavage laminae; grades into underlying unit.	2
Dolomite, light-gray to medium-light-gray, very finely crystalline; weathers light gray; parting into 2- to 6-inch layers; boudinage; veined with calcite and quartz.	2
Dolomite, calcareous, very-light-gray to pinkish-gray, very finely crystalline; parting into ½- to 1-inch layers; some bedding laminae.	½
Traverse 170 feet in S15°E direction across covered area. Stratigraphic thickness unknown.	
Limestone, very-light-gray to medium-light-gray, very finely crystalline; weathers very light gray; finely laminated.	1½
Limestone, medium-dark-gray, very finely crystalline; weathers very light gray to light gray; few dolomite laminae in upper 1 inch.	1
Dolomite, medium-dark-gray, very finely crystalline; weathers light-gray; finely laminated; vcined with calcite and quartz.	1½
Limestone, light-gray, very finely crystalline; weathers very light gray to light gray; few stylolotic laminae; cleavage laminated; pinches and swells.	1
Dolomite, medium-gray and medium-dark-gray, very finely crystalline; weathers light gray; parting into 1- to 9-inch layers; limestone laminae in 9 inch bed located 1 foot below top; shattered; veined with calcite and quartz.	3½
Limestone, very-light-gray to light-olive-gray, very finely crystalline; weathers white to pinkish gray; parting into 2- to 7-inch layers in upper 3 feet; massive in lower 2½ feet; indistinct cleavage laminae; pinches and swells.	5½
Dolomite, medium-light-gray to medium-gray, cryptocrystalline to very finely crystalline; weathers light gray; boudinage; shattered; veined with calcite and quartz.	1½
Limestone, very-light-gray to light-olive-gray to light-brownish gray and medium-dark-gray; weathers white to medium light gray; massive; irregular cleavage laminae; pinches and swells; some isoclinal folding.	6
Dolomite, light-gray to medium-light-gray, very finely crystalline; weathers light gray to yellowish gray; color laminated in part; shattered; veined with calcite and quartz.	1
Limestone, very-light-gray to very-pale-orange to light-olive-gray, very finely crystalline; weathers white to very light gray; cleavage laminated; coarse-grained calcite crystals on some weathered surfaces.	7
Break in exposure. Correlation with following units is not known.	
Dolomite, very-light-gray to medium-light-gray, very finely crystalline; weathers very light gray to yellowish gray; part'ng into 4- to 6-inch layers; veined with calcite and quartz.	1½

	Feet
Limestone, very-light-gray to light-gray, very finely crystalline; weathers very light gray; cleavage laminated.	1
Dolomite, light-gray, very finely crystalline; weathers very light gray to yellowish gray; parting into ½- to 2-inch layers; veined with calcite and quartz.	1½
Limestone, very-light-gray to pinkish-gray, very finely crystalline; weathers very light gray; massive; cleavage laminated.	2
Limestone, medium-light-gray to medium-dark-gray, very finely crystalline; weathers very light gray; few dolomitic limestone laminae; cleavage laminated; coarse-grained calcite crystals on some weathered surfaces.	8
Dolomite, medium-gray, very finely crystalline; weathers yellowish gray to light olive gray; parting into 2- to 5-inch layers.	1½

Section 7

Section in quarry owned by the Manheim Borough Water Authority located 0.2 miles southwest of the southwest boundary of the Borough of Manheim or approximately at 40°09′20″ N latitude and 76°24′15″ W longitude.

(Measured by H. Meisler)

Cocalico Shale

Shale, yellowish gray to light olive gray

	Feet
Covered.	5
Lower Ordovician	
Beckmantown Group	
Ontelaunee Formation	
Dolomite, medium-light-gray, cryptocrystalline to very finely crystalline; weathers very light gray and very light gray to very pale orange; massive.	3
Limestone, dark-gray, cryptocrystalline; weathers medium gray.	1
Dolomite, medium-light-gray, cryptocrystalline to very finely crystalline; weathers very light gray; parting into ½- to 2-foot layers; faint very fine laminae in part.	5
Limestone, dark gray, cryptocrystalline to very finely crystalline; weathers medium light gray; very fine crenulated laminae.	1
Dolomite, medium-light-gray, cryptocrystalline to very finely crystalline; weathers very light gray to yellowish gray; some very fine laminae.	3½
Limestone, dark-gray, cryptocrystalline to very finely crystalline; weathers medium light gray; mottled with medium-light-gray dolomite.	½
Dolomite, medium-light gray, cryptocrystalline to very finely crystalline; weathers very light gray and medium gray; parting into 10- to 12-inch layers; some faint fine laminae.	3
Dolomite, medium-gray and medium-dark-gray; very finely crystalline; weathers very light gray, light gray and medium gray; parting into 1- to 2- foot layers; few 3-inch to 1-foot layers; very finely laminated in part.	27
Continuation of section in part of quarry to the east.	
Dolomite, medium-gray and medium-dark-gray, very finely	

	Feet
crystalline; weathers light gray and light gray to yellowish gray; parting into 1- to 2-foot layers; some faint laminae.	6
Limestone, medium-dark-gray, cryptocrystalline to very finely crystalline; weathers light gray and medium light gray; parting into 4-inch to 1-foot layers; abundant dolomite masses.	2
Dolomite, medium-gray and medium-dark-gray to dark-gray, very finely crystalline; parting into ½- to 2-foot layers; fine laminae in upper 1 foot.	5½
Total	62½
Epler Formation	
Limestone, medium-dark-gray, very finely crystalline; ⅛- to ¼-inch shale laminae at top.	1½
Dolomite, calcareous, medium-dark-gray, very finely crystalline.	1½
Limestone, medium-dark-gray and medium-dark gray to dark-gray, cryptocrystalline to very finely crystalline; parting into ½- to 1½-foot layers; ½-foot bed of dark-gray spotted limestone located 1 foot below top.	3
Dolomite, calcareous, medium-gray and medium-dark-gray, cryptocrystalline to very finely crystalline; weathers yellowish gray to light olive gray; parting into 8- to 18-inch layers; finely laminated.	3
Limestone and interlaminated dolomitic limestone, medium-gray and medium-dark-gray, crytpocrystalline to very finely crystalline; weathers medium light gray and yellowish gray.	1
Dolomite, medium-gray and medium-dark-gray, cryptocrystalline to very finely crystalline; weathers yellowish gray to grayish orange.	1
Limestone, medium-dark-gray and medium-dark-gray to dark-gray, cryptocrystalline to very finely crystalline; weathers medium light gray; very fine cleavage laminae; some fine dolomitic limestone laminae.	4
Limestone, medium-dark-gray and dark-gray, cryptocrystalline to very finely crystalline; massive.	2½
Limestone, medium-dark-gray to dark-gray, cryptocrystalline to very finely crystalline; parting into 4-inch layers.	1
Limestone, medium-dark-gray, very finely crystalline.	1½
Dolomite, medium-gray and medium-dark-gray, very finely crystalline.	1
Limestone, medium-dark-gray, very finely crystalline.	2½
Total	23½

Section 8

Section in quarry along Hammer Creek 1.5 miles south southeast of Brickerville and 2.2 miles southwest of Clay, Pennsylvania or approximately at 40°12′15″ N latitude and 76°17′35″ W longitude.

(Measured by H. Meisler)

Middle Ordovician

Annville Formation

Limestone, medium-dark-gray to dark-gray and dark-gray, very finely crystalline; weathers light gray to medium gray and light

	Feet
olive gray to medium gray; parting into 1- to 2½-foot layers; upper ½ foot laminated.	6
Limestone, light-gray, medium-gray, and medium-dark-gray, very finely crystalline; weathers light gray to medium gray; massive; well laminated; some light gray disrupted laminae up to ¼ inch thick; laminae weather out into ribs in upper 2 feet.	6
Limestone, light-gray, medium-gray, and medium-dark-gray, very finely crystalline; weathers light gray to medium gray; parting into 1½- to 5-inch layers; well laminated; beds bent into tight isoclinal folds.	6–8
Limestone, light-gray, medium-gray, and medium-dark-gray, very finely crystalline; weathers light gray and medium light gray; indistinct parting into 7- to 10-inch layers; laminated in part; folded.	5–7
Limestone, medium-dark-gray and medium-dark-gray to dark-gray, very finely crystalline; weathers medium light gray and medium gray; massive; fine cleavage laminae; laminae weather into ribs on some beds; moderately folded; calcite veins.	11
Limestone, medium-dark-gray, very finely crystalline; weathers medium light gray and medium gray; parting into 2- to 7-inch layers; laminated; laminae weather fluted or ribbed on some beds; silty laminae up to ½ inch thick in upper ½ foot; moderately folded.	11
Limestone, light-gray, medium-light-gray, and medium-dark-gray, very finely crystalline; weathers very light gray to very pale orange and light gray; parting into 2- to 14-inch layers; fine laminae in a few beds.	6½
Limestone, light-gray, medium-gray, and medium-dark-gray, very finely crystalline; weathers light gray, medium gray and very light gray to pale orange; massive; laminated; fluted and ribbed on some weathered surfaces; solution opening 2 feet in diameter.	6
Total	57½ to 61½

Section 9

Section located along Hammer Creek 1.7 miles southwest of Clay and 1.0 mile northeast of Brunnerville, Pennsylvania or approximately at 40°11′50″ N latitude and 76°16′30″ W longitude. The entire stratigraphic sequence is overturned.

(Measured by H. Meisler)

Ordovician

Myerstown Formation

	Feet
Limestone, medium-dark-gray to dark-gray, and dark-gray, very finely crystalline and finely crystalline; parting into ½- to 2½-inch layers; platy.	3
Limestone, medium-dark-gray and dark-gray, finely to medium crystalline, medium crystalline, and medium to coarsely crystalline; weathers medium light gray; parting into ½- to 3-inch layers; platy; few crinoid stem plates.	5½
Limestone, medium-dark-gray and dark-gray, coarsely crystalline; weathers medium gray; parting into 1- to 3-inch layers.	1

	Feet
Covered.	1
Limestone, medium-dark-gray, medium crystalline; parting into 1- to 6-inch layers.	1
Limestone, medium-dark-gray to dark-gray, very finely crystalline; platy to shaly.	½
Limestone, medium-dark-gray, very finely to finely crystalline; parting into 2- to 5-inch layers.	1
Limestone, medium-dark-gray to dark-gray, very finely to finely crystalline; parting into ⅛- to 2-inch layers; shaly and platy.	1½
Limestone, medium-dark-gray and medium-dark-gray to dark gray, finely to medium crystalline, medium to coarsely crystalline and very coarsely crystalline; parting into 1- to 3-inch layers; platy; abundant fossil detritus and crinoid stem plates.	24
Covered.	4
Limestone, shaly, medium-gray, very finely crystalline; weathers medium gray; parting into ¼- to 1-inch layers; lower 4 inches finely laminated.	3½
Limestone, shaly, medium-light-gray and medium-gray, very finely crystalline; weathers medium gray; parting into ¼- to ½-inch layers.	2½
Total	50½
Covered.	4½
Middle Ordovician	
Annville Formation	
Limestone, medium-gray and medium-dark-gray to dark gray, very finely crystalline; weathers medium light gray and medium gray; parting into ½- to 2-inch layers.	9

Table 9. Record of wells

Well location number: See text for description of well-numbering system.
Method of construction: Drl, drilled.
Total depth: R, reported.
Aquifer name: Cv, Vintage; Ck or Cks, Kinzers Formation; Cl, Ledger Formation; Czc, Zooks Corner Formation; Cbs, Buffalo Springs Formation; Ssc, Snitz Creek Formation; Cbssc, Buffalo Springs and Snitz Creek Formations combined; Cm, Millbach Formation; Cr, Richland Formation; Os, Stonehenge Formation; Oe, Epler Formation; Oo, Ontelaunee Formation; Oa, Annville Formation; Omy, Myerstown Formation; Ocs, Conestoga Formation.

Aquifer Composition: Ls, limestone; Dol, dolomite; Sh, shale.
Static water level: R, reported.
Use: A, air conditioning; C, commercial; D, domestic; I, industrial; Irr, irrigation; O, observation; Ps, public supply; S, stock; U, unused.

Well location number	Owner	Driller	Date completed	Altitude above sea-level (feet)	Method of construction	Diameter of casing (inches)	Total depth (feet)	Depth to bottom of casing (feet)	Aquifer		Static water-level		Specific capacity (gpm per foot)	Use	Water quality (Field analysis)[1]	
									Name	Composition	Date measured	Depth below land-surface (feet)			Specific conductance (micromhos at 25°C)	Hardness as $CaCO_3$ (grains per gallon)
000–615–1	Roy Eshelman	Myers	1953	—	Drl	6	55 R	—	Ocs	Ls	9–11–63	48	0.2	D	—	—
2	Phares W. Livengood	Wm. Myers	1957	—	Drl	6	153 R	12	Ocs	Ls	9–11–63	35	4.4	D, S	800	18
3	Clarena K. Keener	—	1953	—	Drl	6	—	—	Ocs	Ls	9–12–63	12	.2	D	660	—
616–1	Aaron O. Brubaker	R. Myers	1959	—	Drl	6	94 R	20	Ocs	Ls	9– 9–63	20	2.9	D, S	800	17
2	Norman E. Davis	—	1953	—	Drl	6	—	—	Ocs	Ls	9–10–63	32	8.5	D	600	16
3	Steward Grim	Wm. Myers	—	—	Drl	6	60 R	—	Ocs	Ls	9–12–63	26	3.9	D	800	17
617–1	L. Ralph Frey	—	1949	—	Drl	6	120 R	—	Ocs	Ls	9– 9–63	36	.17	D	620	16
2	Richard H. Witmer	P. Myers	1960	—	Drl	6	—	—	Ocs	Ls	9– 6–63	33	.43	D, S	530	13
618–1	Robert S. Shenk	Martin Fischer	1952	—	Drl	6	206 R	—	Ocs	Ls	8–28–63	89	.11	D	1000	24
2	Sterling Elmer	R. Myers' Sons, Inc.	1955	—	Drl	6	65 R	40	Ocs	Ls	9– 6–63	55	11	D, S	920	19
3	Melvin M. Groff	do.	1963	—	Drl	6	82 R	—	Ocs	Ls	9–13–63	56	50	D, S	650	15
619–1	Theodore Eastridge	—	—	—	Drl	6	44	—	Ocs	Ls	8–28–63	37	3.7	D	480	11

Table 9. *Record of wells*—Continued

Well location number	Owner	Driller	Date completed	Altitude above sea-level (feet)	Method of construction	Diameter of casing (inches)	Total depth (feet)	Depth to bottom of casing (feet)	Aquifer: Name	Aquifer: Composition	Static water-level: Date measured	Static water-level: Depth below land-surface (feet)	Specific capacity (gpm per foot)	Use	Water quality (Field analysis)[1]: Specific conductance (micromhos at 25°C)	Water quality (Field analysis)[1]: Hardness as $CaCO_3$ (grains per gallon)
2	Barry McComsey	R. Myers' Sons, Inc.	1960	—	Drl	6	—	—	Ocs	Ls	9- 5-63	79	2.6	D	1300	18
620-1	John M. Hoffman	C. E. Miller	1950	—	Drl	6	45 R	—	Ocs	Ls	8-23-63	30	4.8	D	440	9
2	Millersville Borough Authority	P. Myers	—	—	Drl	6	502 R	—	Ocs	Ls	8-30-63	217	8.7	Ps	750	17
621-1	do.	Ralph Myers	1953	—	Drl	6	300 R	—	Ocs	Ls	8-30-63	63	.14	Ps	690	15
2	do.	—	—	—	Drl	—	120 R	—	Ocs	Ls	8-30-63	53	3.1	Ps	750	17
3	Cameron Hawley	—	1930	—	Drl	6	150 R	—	Ocs	Ls	9- 4-63	13	2.2	D, S	500	13
622-1	Abram Kilheffer	—	—	—	Drl	6	38	—	Ocs	Ls	5-21-63	29	110	D, S	550	15
2	Elton Hostetter	Miller	1954	—	Drl	6	180 R	—	Ocs	Ls	9- 4-63	40	.10	S	700	15
000-623-1	Willis Hess	—	1958	—	Drl	6	—	—	Ocs	Ls	8-16-63	56	18	D	380	9
2	Paul Moseman	C. E. Miller	1952	—	Drl	6	110 R	—	Ocs	Ls	8-19-63	52	2.6	D, S	375	8
624-1	Howard Shaub	do.	1961	—	Drl	6	230 R	—	Ocs	Ls	5-24-63	54	.05	D	425	10
2	Paul H. Rohrer	—	1945	—	Drl	6	80 R	—	Ocs	Ls	5-31-63	19	12	D, S	430	14
625-1	Jacob L. Hess	—	—	—	Drl	6	—	—	Ocs	Ls	5-27-63	30	130	D	380	11
2	David K. Miller	Martin Fischer	1960	—	Drl	6	75 R	—	Ocs	Ls	8-21-63	35	4.6	D	440	10
627-1	Robert H. Rohrer	—	—	—	Drl	6	—	—	Ocs	Ls	5-28-63	48	34	D, S	710	18
2	Mrs. Elmer Charles	—	1900	—	Drl	6	—	—	Ocs	Ls	6-14-63	43	4.8	D, S	610	16
628-1	Edward Broomer	—	—	—	Drl	6	—	—	Ocs	Ls	6-13-63	19	49	D	490	13
001-615-1	J. J. Fritz	P. Myers	1963	—	Drl	6	200 R	—	Ocs	Ls	9-11-63	7	.1	S	650	14
2	Robert D. Shoff	do.	1949	—	Drl	6	70 R	—	Ocs	Ls	9-11-63	12	.04	D	800	17
616-1	Lee Brenner	—	—	—	Drl	6	50 R	—	Ocs	Ls	9-13-63	8	4.7	C	1090	24
2	H. R. Albright	R. Myers' Sons, Inc.	1963	—	Drl	6	102 R	—	Ocs	Ls	9-23-63	26	.52	D	690	17
617-1	Sam Sinopoli	P. Myers	1948	—	Drl	6	85 R	—	Ocs	Ls	8-28-63	41	2	C	940	22
2	Rockford Museum	Herr The Pump Man	—	—	Drl	6	—	—	Ocs	Ls	9- 6-63	32	2.6	C	—	—
619-1	Maynard Southard	—	—	—	Drl	6	80 R	—	Ocs	Ls	8-28-63	30	.09	D	750	16

2	David T. Copenhafer	—	—	—	Drl	—	—	—	Ocs	Ls	9– 5–63	43	.66	D	400	9
3	Richard Fitzgerald	P. Myers	1949	—	Drl	6	108 R	35	Ocs	Ls	8–30–63	24	16	D	640	14
620–1	John H. Hartleib	—	—	—	Drl	—	125 R	—	Ocs	Ls	8–23–63	32	—	D	—	—
2	Robert Hudson	Wm. Myers	1959	—	Drl	6	110 R	—	Ocs	Ls	8–27–63	70	.8	D	850	19
621–1	John M. Kilheffer	R. Myers' Sons, Inc.	1959	—	Drl	6	90 R	30	Ocs	Ls?	8–22–63	40	.43	D	750	15
622–1	L. Howard Martin	do.	1961	—	Drl	6	—	—	Ocs	Ls	5–24–63	48	.51	D	720	22
2	H. H. Haverstick, Jr.	—	—	—	Drl	6	—	—	Ocs	Ls	8–26–63	12	13	S	540	12
623–1	Iven Charles, Sr.	Martin Fischer	1958	—	Drl	6	50	18	Ocs	Ls	5–23–63	22	3.2	D, S	950	24
624–1	Harold Wilkinson	—	—	—	Drl	—	—	—	Cv	Dol	8–22–63	10	.44	D	—	10
001–625–1	Ray W. Gibble	R. Myers' Sons, Inc.	1952	—	Drl	6	90 R	—	Ocs	Ls	5–27–63	38	1.2	D	—	—
2	Charles S. Habecker	—	1900	—	Drl	6	65 R	—	Ocs	Ls	5–31–63	44	.37	D, S	380	10
3	Jacob Siegrist	R. Myers' Sons, Inc.	1952	—	Drl	6	155 R	—	Cks	Sh	—	—	1.6	Irr	220	5
628–1	Morris Kauffman	—	1900	—	Drl	6	—	—	Ocs	Ls	6– 7–63	6	.59	D	590	18
2	R. P. Williams	—	—	—	Drl	6	—	—	Ocs	Ls	—	—	2	D	700	20
002–615–1	Charles B. Hess	P. Myers	1947	—	Drl	6	400 R	—	Ocs	Ls?	8– 6–63	91	.02	S	1390	29
2	Permutit Co.	do.	1954	—	Drl	8	125 R	—	Ocs	Ls	8–12–63	31	23	I	690	16
3	James R. Landis	do.	1948	—	Drl	6	79 R	—	Cl	Dol	8–13–63	44	16	D, S	1130	25
616–1	John G. Fetter	—	1949	—	Drl	6	152	—	Ocs	Ls	8–19–63	51	.21	D	1210	2
617–1	Eber Reese	—	—	—	Drl	6	<57	—	Ocs	Ls	8–27–63	22	30	I	1100	24
618–1	Watt and Shand	—	1936	—	Drl	6	155 R	60	Ocs	Ls	9– 5–63	23	8.2	A	—	—
2	do.	—	1924	—	Drl	6	265 R	160	Ocs	Ls	9– 5–63	41	—	A	—	—
619–1	Charles Spidle	Ben Miller	1934	—	Drl	6	90 R	—	Ocs	Ls	8–30–63	20	4.5	C	950	21
2	Robert McMurtrie	—	1958	—	Drl	6	180 R	—	Ocs	Ls	9– 5–63	17	.41	D	780	21
621–1	Harry L. Overton	Myers	1933	—	Drl	6	290 R	—	Ocs	Ls	9– 3–63	44	.26	D	900	17
2	A. D. Medsger	—	1926	—	Drl	6	74	—	Ocs	Ls	9– 3–63	42	.03	D	—	—
3	Harry Kreidy	R. Myers' Sons, Inc.	—	—	Drl	6	136	—	Ocs	Ls	8–27–63	38	8	D	540	11
622–1	Gulf Oil Corp.	—	—	—	Drl	6	—	—	Ocs	Ls	6–13–63	14	.92	C	550	18
623–1	Frank Henne	—	1946	—	Drl	6	129 R	—	Ocs	Ls	5–20–63	46	.06	D	440	15
2	Ben E. Mann Estate	Miller	—	—	Drl	6	100 R	—	Ocs	Ls	5–20–63	8	3.8	S	480	14
624–1	Garden Spot Air Park Inc.	—	—	—	Drl	6	76	—	Cv	Dol	5–21–63	17	1.4	C	450	12
2	Amos Burkhart	—	1935	—	Drl	6	80 R	—	Cks	Sh	5–23–63	9	31	D	370	11
3	Martin Fischer	Martin Fischer	1953	—	Drl	6	<100 R	—	Cv	Dol	6–12–63	7	.12	D	340	9
626–2	Maurice Roth	—	—	—	Drl	6	155 R	—	Ocs	Ls	6–10–63	24	.06	D	560	16

[1] Date of field analysis measurement is the same as shown for static water-level.

Table 9. *Record of wells*—Continued

Well location number	Owner	Driller	Date completed	Altitude above sea-level (feet)	Method of construction	Diameter of casing (inches)	Total depth (feet)	Depth to bottom of casing (feet)	Aquifer: Name	Aquifer: Composition	Static water-level: Date measured	Static water-level: Depth below land-surface (feet)	Specific capacity (gpm per foot)	Use	Water quality (Field analysis)[1]: Specific conductance (micromhos at 25°C)	Water quality (Field analysis)[1]: Hardness as $CaCO_3$ (grains per gallon)
002–627–1	William Dellet	Martin Fischer	1959	—	Drl	—	170 R	—	Ocs	Ls	6– 7–63	20	20	Ps	800	26
003–615–1	Benjamin F. Haum	Myers	1950	—	Drl	6	80 R	—	Cl	Dol	8– 6–63	24	.58	D	—	19
2	Robert Glass	P. Myers	1963	—	Drl	6	145 R	4	Cl	Dol	8– 8–63	20	.42	S	590	14
616–1	H. Esbelman	do.	—	—	Drl	6	289 R	1	Cl	Dol	8–14–63	27	.67	D	590	16
2	Amos S. Keene	Miller	1934	—	Drl	6	92 R	5	Czc	Dol	8–22–63	46	2.6	D	860	20
617–1	Consumer Ice Co.	R. Myers' Sons, Inc.	1957	—	Drl	8	150 R	50	Cl	Dol	—	20 R	40	I	—	—
2	do.	—	—	—	Drl	6	475 R	—	Cl	Dol	—	—	—	I	—	—
3	Mr. Esbenshade	—	—	—	Dug	—	—	—	Cl	Dol	—	—	—	—	—	—
					Drl	6	60 R	—	Cl	Dol	8– 1–63	17	8	D	610	16
618–1	Julia Hagen	Myers	1956	—	Drl	6	65 R	—	Cl	Dol	8–26–63	32	14	D	700	16
619–1	Calder Mfg. Co.	—	—	—	Drl	6	31	—	Cl	Dol	8–22–63	12	1.4	Ps	580	15
620–1	Joseph B. Resch	R. Myers' Sons, Inc.	1953	—	Drl	6	<50 R	—	Cl	Dol	8–15–63	8	.91	D	475	12
621–1	Jessee Epps	—	—	—	Drl	6	55	—	Ck	Ls	8–16–63	34	.6	D	—	—
2	Mr. Brubaker	—	—	—	Drl	6	49	—	Ck	Ls	8–19–63	35	38	D	550	13
3	Glenn Huber	—	—	—	Drl	6	>200	—	Cl	Dol	8–20–63	33	.57	D	1225	26
4	Mrs. Louis Lockwood	—	—	—	Drl	6	80 R	—	Ocs	Ls	8–26–63	30	.12	D	775	18
622–1	Haldy Becker	H. K. Honberger Sons	1946	—	Drl	6	144 R	69	Cv or Cks	Dol or Ls	8–16–63	49	.03	D	750	15
2	Robert M. Steffy	—	—	—	Drl	6	65 R	—	Cks	Sh	6–27–63	29	3.4	D	360	8
624–1	Chris Miller Estate	—	—	—	Dug	—	—	—	Cl	Dol	10–12–62	23	—	D, S	330	9
2	Dave Hostetter	—	—	—	Dug	—	29	—	Cl	Dol	10–12–62	27	—	D	320	8
3	Sander Machine Co.	Aaron W. Martin	1951	—	Drl	6	195 R	—	Cl	Dol	10–23–62	37	—	D, I	310	8

2	David H. Hubley	—	—	—	Dug	—	22	—	Cl	Dol	[illegible]	[illegible]	—	[illegible]	[illegible]	[illegible]
					Drl	—	—	—	Cl	Dol	10– 9–62	20	—	D	520	12
3	Joseph Sebelist	—	1961	—	Drl	6	80 R	—	Cl	Dol	10– 9–62	30	130	D	—	—
003–625–4	Amos K. Mellinger	—	1959	—	Drl	6	160–180 R	—	Cl	Dol	10–23–62	40	.16	D	640	13
5	do.	—	—	—	Dug	—	42	—	Cl	Dol	10–23–62	36	—	U	—	—
6	Jacob L. Charles	—	—	—	Dug	—	27	—	Cl	Dol	10–24–62	23	—	—	—	—
					Drl	—	—	—	Cl	Dol	10–24–62	23	—	D, S	325	7
7	John C. Butzer	—	—	—	Dug	—	25	—	Cl	Dol	10–24–62	24	—	—	—	—
					Drl	—	—	—	Cl	Dol	10–24–62	—	—	D	700	15
626–1	Clayton Diffenderfer	—	—	—	Dug	—	18	—	Cl	Dol	10–24–62	12	—	U	375	9
2	Alma Ditzler	—	—	—	Dug	—	—	—	Cl	Dol	—	—	—	—	—	—
					Drl	—	—	—	Cl	Dol	10–24–62	18	—	D	955	18
3	Moses Shirk	—	—	—	Dug	—	—	—	Czc	Dol	10–24–62	27	—	—	—	—
					Drl	—	—	—	Czc	Dol	10–24–62	27	—	D	470	10
4	Carl Slinkman	—	—	—	Drl	—	—	—	Cl	Dol	10–24–62	17	—	D	320	7
5	Joseph Forrest	—	—	—	Dug	—	55	—	Cl	Dol	10–24–62	29	—	U	—	—
6	Jacob Bowers	—	—	—	Dug	—	50	—	Cl	Dol	10–24–62	47	—	D, S	315	7
7	Joseph Forrest	—	—	—	Dug	—	42 R	—	Cl	Dol	10–24–62	20	—	D	370	9
8	Edward Getz	—	1942	—	Drl	6	52	—	Czc	Dol	10–24–62	27	—	D	400	9
627–1	West Hempfield Township	H. K. Honberger Sons	1958	—	Drl	—	500 R	—	Cbs	Dol and Ls	10–10–62	38	—	Ps	—	—
2	Minnie Habacker	—	—	—	Dug	—	27	—	Cbs	Dol and Ls	10–12–62	11	—	D	900	18
3	Lloyd Miller	H. K. Honberger Sons	1962	—	Drl	6	400 R	—	Czc	Dol	6–12–62	62	1.5	D	450	11
628–2	Margaret Ness	Kauffman	1958	—	Drl	6	78 R	—	Cl	Dol	10–10–62	36	—	D	925	26
629–1	J. Arthur Swarr	H. K. Honberger Sons	1948	—	Drl	6	127 R	—	Cbs	Dol and Ls	10–10–62	63	.17	D, S	840	19
2	Howard Witmer	do.	—	—	Drl	6	80 R	—	Cbs	Dol and Ls	10–10–62	47	—	D	450	10
3	John H. Conrad	—	—	—	Drl	6	—	—	Cbs	Dol and Ls	10–10–62	51	—	Ps	450	11
004–615–1	C. L. Heller	—	—	—	Drl	6	>200 R	—	Cbs	Dol and Ls	8– 8–63	147	.03	D, S	—	—
2	Mr. Shoab	—	—	—	Drl	6	111	—	Czc	Dol	8–14–63	19	.14	D	—	—
3	Ralph Hubley	H. K. Honberger Sons	1963	—	Drl	6	142 R	8	Czc	Dol	9– 3–63	21	.09	C	1350	26
616–1	H. C. Burrichter	—	—	—	Drl	—	228 R	—	Czc	Dol	8–13–63	87	.06	D	490	16
617–1	Lloyd Moore	H. K. Honberger Sons	1947	—	Drl	6	118	—	Czc	Dol	7–25–63	61	.06	P	1090	24

[1] Date of field analysis measurement is the same as shown for static water-level.

Table 9. *Record of wells*—Continued

Well location number	Owner	Driller	Date completed	Altitude above sea-level (feet)	Method of construction	Diameter of casing (inches)	Total depth (feet)	Depth to bottom of casing (feet)	Aquifer: Name	Aquifer: Composition	Static water-level: Date measured	Static water-level: Depth below land-surface (feet)	Specific capacity (gpm per foot)	Use	Water quality (Field analysis)[1]: Specific conductance (micromhos at 25°C)	Water quality (Field analysis)[1]: Hardness as $CaCO_3$ (grains per gallon)
004-617-2	E. R. Royer Estate	P. Myers	1960	—	Drl	6	160 R	12	Czc	Dol	7-29-63	16	.52	D, S	—	—
3	Humble Oil Co.	—	—	—	Drl	6	101	—	Czc	Dol	9-23-63	9	.58	C	640	16
618-1	Erb Bros. Inc.	—	1930	—	Drl	6	218	—	Czc	Dol	7-26-63	29	.06	D, Irr	980	22
619-1	Edgar Sterrett	—	—	—	Drl	6	—	—	Cl	Dol	6-26-63	33	2.5	D	—	—
2	Wm. Schwartz	R. Myers' Sons, Inc.	1938	—	Drl	6	70 R	—	Cl	Dol	7-31-63	13	.37	D	650	15
620-1	Fildor Realty	do.	1959	—	Drl	—	—	—	Ck or Cl	Dol	6- 9-63	21	1.9	C	1040	23
2	Clair Benton	—	—	—	Drl	6	—	—	Cks	Sh	6-14-63	24	.09	C	960	19
3	Quaker State Metals Co.	R. Myer's Sons, Inc.	1962	—	Drl	6	82	—	Cl	Dol	7-1 -63	42	85	I	500	15
4	do.	do.	1962	—	Drl	6	222 R	43	Cl	Dol	7- 1-63	43	—	U	—	—
5	do.	do.	1962	—	Drl	6	7	43	Cl	Dol	7- 2-63	40	2.9	O	590	18
6	do.	do.	1962	—	Drl	6	262 R	41	Cl	Dol	7- 2-63	26	—	U	—	—
7	do.	do.	1962	—	Drl	6	67	60	Cl	Dol	7- 5-63	33	11	O	690	20
8	do.	do.	1962	—	Drl	6	90	42	Cl	Dol	7- 3-63	28	1.5	U	1250	17
9	do.	do.	1962	—	Drl	6	202 R	41	Cl	Dol	7- 3-63	21	—	U	—	—
10	do.	do.	1962	—	Drl	6	27	26	Cl	Dol	7- 7-63	17	2.9	U	—	—
11	do.	do.	1962	—	Drl	6	202 R	43	Cl	Dol	7- 7-63	17	—	U	—	—
12	do.	do.	1962	—	Drl	6	222 R	22	Cl	Dol	—	—	—	U	—	—
13	do.	do.	1962	—	Drl	6	102 R	20	Cl	Dol	—	—	—	U	—	—
14	do.	do.	—	—	Drl	6	117 R	20	Cl	Dol	—	—	—	I	—	—
15	do.	do.	—	—	Drl	6	76 R	—	Cl	Dol	—	—	—	I	—	—
16	do.	do.	—	—	Drl	12	58 R	—	Cl	Dol	—	—	—	I	—	—
17	do.	do.	—	—	Drl	6	122 R	42	Cl	Dol	—	—	—	U	—	—
18	do.	do.	—	—	Drl	6	142 R	42	Cl	Dol	—	—	—	U	—	—

621-1	Roy Mosemann	Martin Fischer	1953	—	Drl	—	65 R	—	Cl	Dol	6-24-63	29	1.2	D, S	725	18
004-622-2	Boyd Abbott, Jr.	—	—	—	Dug	—	16	—	Cv	Dol	10-25-62	13	—	D	480	10
3	Moses Stoltzfuss	—	—	—	Dug	—	18	—	Cv	Dol	10-25-62	15	—	U	—	—
4	Harry Swarr	—	—	—	Dug	—	12	—	Cv	Dol	10-25-62	11	—	D	400	8
5	Henry C. Leary	—	1948	—	Drl	6	26 R	13	Cv	Dol	8-20-63	8	8.8	D, S	450	9
623-1	Robert Haverstein	—	—	—	Dug	—	49	—	Cv	Dol	10-22-62	46	—	U	—	—
2	Richard Shotzberger	—	—	—	Dug	—	35	—	Cv	Dol	10-25-62	31	—	D	350	7
624-1	Isaac Stoner	—	—	—	Dug	—	8	—	Czc	Dol	10- 9-62	7	—	D, S	520	13
2	Raymond Kauffman	—	—	—	Drl	6	—	—	Czc	Dol	10- 9-62	6	.04	S	450	11
3	East Hempfield Water Autbority	H. K. Honberger Sons	—	—	Drl	—	265 R	—	Cl	Dol	10-22-62	20	30	Ps	410	10
4	Daniel M. Heisey	R. Myers' Sons, Inc.	1955	—	Drl	—	60 R	—	Cv	Dol	10-22-62	16	—	D, S	600	15
5	do.	—	—	—	Dug	—	21	—	Cv	Dol	10-22-62	17	—	U	—	—
6	D. Baker Kauffman	—	—	—	Dug	—	19	—	Cbs	Dol and Ls	10-22-62	11	—	S	690	16
7	David Miller	—	—	—	Dug	—	52	—	Czc	Dol	10-23-62	50	—	D	800	16
8	J. H. Kaufman	—	—	—	Drl	6	—	—	Czc	Dol	10-23-62	23	—	D, S	450	9
625-1	S. B. Nolt	R. Myers' Sons, Inc.	1915	—	Drl	6	68 R	—	Czc	Dol	10- 5-62	18	—	D, S	470	12
2	Elizabeth Young	—	—	—	Dug	—	24	—	Cbs	Dol and Ls	10- 5-62	22	—	S	—	—
3	Clarence Nolt	—	—	—	Dug	—	43	—	Czc	Dol	10- 5-62	40	—	—	—	—
					Drl	—	—	—	Czc	Dol	—	—	—	D	575	14
4	do.	R. Myers' Sons, Inc.	—	—	Drl	6	165 R	65	Czc	Dol	10- 5-62	38	—	S	500	11
5	Lester Charles	—	—	—	Drl	6	88 R	—	Czc	Dol	10- 8-62	20	—	D	630	15
6	Elmer S. Musser	—	—	—	Dug	—	30	—	Czc	Dol	10- 9-62	27	—	—	—	—
					Drl	—	—	—	Czc	Dol	—	—	—	D	500	12
7	Daniel G. Forrey	—	—	—	Dug	—	20	—	Cl	Dol	10-9 -62	17	—	D, S	470	11
8	Elmer Musser	—	—	—	Dug	—	23	—	Czc	Dol	10- 9-62	22	—	—	—	—
					Drl	—	—	—	Czc	Dol	—	—	—	D	510	13
9	Robert Bender	—	—	—	Dug	—	20	—	Cbs	Dol and Ls	10-22-62	13	—	D, S	—	—
10	Amherst Industries	—	1947	—	Drl	6	175 R	—	Cbs	Dol and Ls	10-22-62	11	—	Ps, I	650	17
004-626-1	Paul E. McKinney	—	—	—	Dug	—	36	—	Cbssc	Dol and Ls	10- 2-62	31	—	D, S	450	14
2	do.	H. K. Honberger Sons	1960	—	Drl	6	63	11	Cbssc	Dol and Ls(?)	10- 2-62	37	200	U	—	—
3	Daniel H. Fox	—	—	—	Dug	—	33	—	Czc	Dol	10- 2-62	28	—	D	500	15
4	R. J. Kline	Sam Kaylor	1960	—	Drl	6	79 R	—	Czc	Dol	10- 2-62	38	.1	D	540	14

[1] Date of field analysis measurement is tbe same as sbown for static water-level.

Table 9. *Record of wells*—Continued

Well location number	Owner	Driller	Date completed	Altitude above sea-level (feet)	Method of construction	Diameter of casing (inches)	Total depth (feet)	Depth to bottom of casing (feet)	Aquifer: Name	Aquifer: Composition	Static water-level: Date measured	Static water-level: Depth below land-surface (feet)	Specific capacity (gpm per foot)	Use	Water quality (Field analysis)[1]: Specific conductance (micromhos at 25°C)	Water quality (Field analysis)[1]: Hardness as $CaCO_3$ (grains per gallon)
5	R. J. Kline	—	—	—	Dug	—	30 R	—	Czc	Dol	10– 2–62	26	—	U	410	12
6	Ernest J. Sauder	Martin Fischer	1953	—	Drl	6	200 R	—	Cbs	Dol and Ls	10– 2–62	49	.05	D, S	750	20
7	do.	Peter Sheim	1936	—	Drl	—	90 R	—	Cbs	Dol and Ls	10– 2–62	7	—	U	750	19
8	do.	—	—	—	Dug	—	19	—	Cbs	Dol and Ls	10 2–62	16	—	U	—	—
9	Lloyd Nolt	R. Myers' Sons, Inc.	—	—	Drl	6	19	—	Cl	Dol	10– 2–62	10	—	D	440	12
10	Lloyd W. Nolt	do.	1936	—	Drl	6	105 R	—	Czc	Dol	10– 2–62	36	—	D	590	15
11	do.	—	—	—	Dug	—	19	—	Czc	Dol	10– 5–62	15	—	U	—	—
12	R. B. Nolt	—	—	—	Dug	—	21	—	Czc	Dol	10– 5–62	15	—	D, S	850	17
13	J. Harlan Burkhart	—	1954	—	Drl	6	>125 R	—	Cbs	Dol and Ls	10– 5–62	13	.22	D, S	550	14
14	E. Robert Nolt	—	—	—	Dug	—	12	—	Chs	Dol and Ls	10– 5–62	8	—	D, S	500	13
627–1	John Melhorn	—	—	—	Dug	—	20	—	Cbssc	Dol	9–24–62	18	—	U	—	—
2	Paul Conley	—	—	—	Drl	—	—	—	Cbssc	Dol and Ls	9–24–62	7	.62	D, S	450	16
3	Herbert Hilkemeir	—	—	—	Drl	6	30 R	—	Czc	Dol	9–24–62	26	—	D	750	27
4	Paul Conley	—	1900	—	Dug	—	30	—	Czc	Dol	9–24–62	24	—	—	—	—
					Drl	—	150	—	Czc	Dol	9–24–62	24	—	D, S	700	19
5	Howard Musser	—	—	—	Dug	—	—	—	Czc	Dol	10–10–62	30	—	D, S	560	13
6	Emma Musser	—	—	—	Dug	—	15 R	—	Cbs	Dol and Ls	10–24–62	14	—	U	—	—
628–1	Henry Miller	R. Myers' Sons, Inc.	—	—	Drl	6	—	—	Cbs	Dol and Ls	9–24–62	78	—	D, S	600	17
2	do.	—	—	—	Dug	—	16	—	Cbs	Dol	9–24–62	14	—	U	650	19
3	Amos Martin	—	—	—	Drl	6	87 R	—	Czc	Dol	9–24–62	25	.96	D, S	700	17
4	Chris Nolt, Sr.	R. Myers' Sons, Inc.	1956	—	Drl	6	140 R	—	Czc	Dol	9–25–62	34	—	D, S	740	16
5	Nissley Estate	do.	—	—	Drl	6	90 R	—	Cl	Dol	9–25–62	59	—	D, S	650	18
6	Robert Lichtz	—	1908	—	Dug	—	—	—	Cl	Dol	—	—	—	—	—	—

004–628–7	Lloyd Miller	H. K. Honberger Sons	1958	—	Drl	6	425 R	60	Cl	Dol	10–12–62	64	—	Ps	580	13
8	do.	do.	1957—	—	Drl	6	290 R	60	Cl	Dol	10–12–62	36	—	Ps	—	—
629–1	Henry Mellinger	—	—	—	Drl	6	—	—	Cbs	Dol and Ls	9–25–62	41	—	S	900	20
2	Kenneth Alexander	R. Myers' Sons, Inc.	—	—	Drl	6	143 R	16	Czc	Dol	9–25–62	52	—	D	1200	29
3	Lloyd Derr	—	—	—	Drl	—	—	—	Czc	Dol	9–25–62	48	—	D	980	22
4	William K. Fogie	R. Myers' Sons, Inc.	1940	—	Drl	6	72	—	Czc	Dol	9–25–62	41	—	D, S	750	15
5	Charles Gantz	—	—	—	Dug	—	41	—	Czc	Dol	9–26–62	37	—	D	650	11
6	Charles Fogie	—	—	—	Dug	—	31	—	Czc	Dol	9–26–62	30	—	D	580	11
7	Warren Fletcher	—	1950	—	Drl	6	200 R	—	Czc	Dol	—	—	—	D	590	15
8	Donald L. Miller	—	—	—	Dug	—	60 R	—	Czc	Dol	9–26–62	50	—	D	375	7
9	do.	—	—	—	Drl	6	123 R	—	Czc	Dol	9–26–62	109	.15	D	760	19
10	C. S. Loechner	—	—	—	Drl	6	—	—	Czc	Dol	9–26–62	86	—	D	740	20
11	Clyde Mumma	—	—	—	Dug	—	36	—	Cl	Dol	9–26–62	27	—	D, S	620	16
12	Cyrus Graybill	H. K. Honberger Sons	—	—	Drl	6	79 R	—	Cl	Dol	9–26–62	54	—	D, S	600	16
005–615–1	C. Sinz	R. Myers' Sons, Inc.	1963	—	Drl	6	160 R	20	Czc	Dol	7–23–63	31	.1	D	590	15
2	E. E. Murry	—	1961	—	Drl	—	221 R	—	Czc or Cbs	Dol and Ls	7–24–63	56	.1	D	650	18
616–1	Elmer Landis	—	1948	—	Drl	6	160	—	Czc	Dol	7–17–63	32	5.1	D	550	14
617–1	E. J. Danz	R. Myers' Sons, Inc.	1950	—	Drl	6	51	—	Cv	Dol	7–18–63	30	.36	D	540	14
618–1	Charles C. Dombach	—	—	—	Drl	5	—	—	Czc	Dol	7–31–63	18	6	D, S	—	15
2	Robert T. Campbell	—	1955	—	Drl	6	76	—	Cl	Dol	8–27–63	39	3.8	D	520	13
619–1	Mrs. M. L. Smith	R. Myers' Sons, Inc.	1949	—	Drl	6	60	—	Cv	Dol	6–21–63	52	74	D	360	9
2	Bell Telephone Co.	Ernst	1956	—	Drl	6	96 R	40	Cv	Dol	—	—	.38	C	—	10
620–1	S. Clyde Weaver, Inc.	R. Myers' Sons, Inc.	1960	—	Drl	6	143 R	—	Cl	Dol	6– 6–63	42	.59	D, C	640	17
2	Walter E. Evans	P. Myers	1946	—	Drl	6	69 R	—	Cl	Dol	6–17–63	21	2.6	D	630	11
005–621–1	Elmer K. Kreider	R. Myers' Sons, Inc.	1961	—	Drl	6	175 R	20	Cl	Dol	6–18–63	19	.65	S	480	13
2	P. G. Gingrich	—	1953	—	Drl	6	81	—	Cl	Dol	6–21–63	23	6.8	D	700	14
622–1	Selana Landis	R. Myers' Sons, Inc.	—	—	Dug	—	14	—	Cl	Dol	11– 1–62	11	—	—	—	—
					Drl	—	—	—	Cl	Dol	—	—	—	D	605	15
2	John S. Landis	do.	1957	—	Dug	—	—	—	Czc or Cl	Dol	11– 1–62	20	—	—	—	—
					Drl	6	232 R	23	Czc or Cl	Dol	11– 1–62	19	.9	S, Irr	1700	28

[1] Date of field analysis measurement is the same as shown for static water-level.

Table 9. *Record of wells*—Continued

Well location number	Owner	Driller	Date completed	Altitude above sea-level (feet)	Method of construction	Diameter of casing (inches)	Total depth (feet)	Depth to bottom of casing (feet)	Aquifer: Name	Aquifer: Composition	Static water-level: Date measured	Static water-level: Depth below land-surface (feet)	Specific capacity (gpm per foot)	Use	Water quality (Field analysis)[1]: Specific conductance (micromhos at 25°C)	Water quality (Field analysis)[1]: Hardness as $CaCO_3$ (grains per gallon)
3	John S. Landis	—	—	—	Dug	—	22	—	Czc	Dol	11– 1–62	20	—	—	—	—
					Drl	—	—	—	Czc	Dol	—	—	—	D	925	22
4	Wayne Hottenstein	—	—	—	Dug	—	20	—	Czc	Dol	11– 1–62	19	—	D, S	950	19
5	J. Mark Swarr	—	—	—	Dug	—	21	—	Ck	Dol or Ls	10–25–62	17	—	D, S	670	15
6	Landis Metzler	—	—	—	Dug	—	12	—	Czc	Dol	11– 2–62	7	—	D	560	14
7	do.	R. Myers' Sons, Inc.	—	—	Drl	7	25	—	Czc	Dol	11– 2–62	5	—	S	605	15
8	Paul L. Neff	—	1943	—	Drl	—	147 R	—	Czc	Dol	6–18–63	24	.91	D, S	690	18
9	Suburban Propane Co.	—	1953	—	Drl	6	60 R	—	Cl	Dol	6–14–63	22	28	C	520	13
623–1	W. Scott Nissley	—	—	—	Dug	—	51	—	Cl	Dol	10–23–62	9	—	U	—	—
2	Benjamin Landis	H. K. Honberger Sons	1962	—	Drl	6	260 R	—	Cks	Sh	10–23–62	33	.05	O	490	—
3	do.	—	—	—	Dug	—	36 R	—	Cks	Sh	10–23–62	32	—	U	345	9
4	do.	H. K. Honberger Sons	1962	—	Drl	5	52 R	—	Cks	Sh	10–23–62	29	—	D, S	370	9
5	Anna Bowers	—	—	—	Dug	—	16 R	—	Cl	Dol	10–25–62	12	—	D	600	15
6	Lloyd Denlinger	—	—	—	Dug	—	16	—	Ck	Dol or Ls	10–25–62	14	—	D	580	14
7	John Hartman	H. K. Honberger Sons	1947	—	Drl	6	60 R	—	Cks	Sh	10–25–62	22	—	D	—	—
8	do.	—	—	—	Dug	—	28	—	Cks	Sh	10–25–62	22	—	U	—	—
9	W. E. Alexander	R. Myers' Sons, Inc.	1954	—	Drl	6	180 R	—	Czc or Cl	Dol	10–26–62	32	.06	D	—	—
10	Martin B. Thomas	—	—	—	Dug	—	19	—	Cl	Dol	10–26–62	14	—	D, S	650	16
11	Earl Landis	Sam Kaylor	1959	—	Drl	6	102 R	—	Czc	Dol	11– 1–62	23	—	D, S	740	18
12	do.	—	—	—	Dug	—	14	—	Czc	Dol	11– 1–62	11	—	D	655	9
13	John B. Gochnauer	R. Myers' Sons, Inc.	1956	—	Drl	6	129	—	Cv	Dol	11– 1–62	17	.17	O	545	—
005–623–14	John B. Gochnauer	—	—	—	Dug	—	11	—	Czc	Dol	11– 1–62	5	—	D	650	14
15	Warren Witmer	—	—	—	Dug	—	—	—	Czc	Dol	—	—	—	—	—	—

16	do.	—	—	—	Drl	6	47	—	Czc	Dol	11– 2–62	15	—	U	1100	22
17	Leroy Bricker	R. Myers' Sons, Inc.	—	—	Drl	5	120 R	—	Czc	Dol	11– 7–62	41	—	D, Ps	625	16
18	D. G. Nelson	do.	—	—	Drl	—	200 R	—	Cl	Dol	11– 2–62	9	—	D	790	17
624–1	Arthur Miller	—	1937	—	Drl	—	170 R	—	Cks	Sh	10–22–62	16	2.2	D	350	9
2	J. B. Mumma Estate	—	—	—	Dug	—	17	—	Cks	Sh	10–22–62	15	—	U	—	—
3	do.	—	—	—	Drl	7	117	—	Cks	Sh	10–22–62	11	—	D, S	480	12
4	J. Harold Kauffman	—	—	—	Dug	—	22	—	Cv	Dol	10–22–62	18	—	D	350	8
5	Barton Gehman	—	—	—	Dug	—	19	—	Czc	Dol	10–26–62	13	—	U	—	—
6	—	—	—	—	Dug	—	10	—	Cl	Dol	10–26–62	8	—	—	—	—
7	Walter C. Doerr	—	—	—	Dug	—	16	—	Czc	Dol	10–30–62	12	—	U	—	—
8	Henry J. Wickenheiser	—	—	—	Dug	—	26	—	Ck	Dol or Ls	10–30–62	12	—	U	—	—
9	Harry S. Mumma	—	—	—	Dug	—	—	—	Czc	Dol	—	—	—	—	—	—
					Drl	6	95	—	Czc	Dol	9–24–62	26	—	D	810	21
10	do.	—	—	—	Dug	—	21	—	Czc	Dol	9–24–62	16	—	S	745	20
625–1	Raymond Hess	—	—	—	Drl	6	67	—	Cl?	Dol	10– 5–62	3	—	Irr	—	—
2	Edward Wissler	—	—	—	Drl	—	180 R	—	Czc	Dol	10– 8–62	24	—	U	—	—
3	do.	—	—	—	Dug	—	27	—	Czc	Dol	10– 8–62	23	—	S	480	12
4	J. Clayton Bender	—	—	—	Dug	—	37	—	Czc	Dol	10– 8–62	24	—	U	—	—
5	do.	R. Myers' Sons, Inc.	1959	—	Drl	6	230 R	35	Czc	Dol	10– 8–62	23	—	D, S	740	17
6	John L. Charles	M. A. Stoltzfuss	1950	—	Drl	6	88 R	—	Ck	Dol or Ls	10– 8–62	24	.64	D, S	960	23
7	Ben Hess	—	—	—	Dug	—	25	—	Czc	Dol	10–30–62	22	—	S	—	—
626–1	J. Miller Eshelman & Son, Inc.	—	—	—	Drl	6	545 R	—	Cbssc	Dol and Ls	10– 1–62	178	—	D, S	640	17
005–626–2	J. Miller Eshelman & Son, Inc.	—	—	—	Drl	6	193	—	Cbssc	Dol and Ls	10– 1–62	21	—	U	—	—
3	J. Lester Charles	Sam Kaylor	—	—	Drl	6	192 R	50	Cbssc	Dol	10– 1–62	29	1.7	D	640	18
4	do.	—	—	—	Dug	—	29	—	Cbssc	Dol	10– 1–62	—	—	—	—	—
					Drl	6	42	—	Cbssc	Dol	10– 1–62	30	—	U	—	—
5	Minnie Gantz	—	—	—	Dug	—	22	—	Cbssc	Dol and Ls	10– 2–62	17	—	—	—	—
					Drl	6	159	—	Cbssc	Dol and Ls	10– 2–62	44	—	D, S	650	18
6	Jacob Burkhart	R. Myers' Sons, Inc.	1960	—	Dug	—	29	—	Cbssc	Dol and Ls	10– 8–62	23	—	—	—	—
					Drl	6	300 R	—	Cbssc	Dol and Ls	10– 8–62	23	—	D, S	800	20
627–1	J. H. Nissley	—	—	—	Dug	—	40 R	—	Cm	Ls	9–20–62	34	—	D, S	640	17
2	do.	—	—	—	Dug	—	26	—	Cm	Ls	9–20–62	19	—	D	640	14
3	John Nissley	—	—	—	Dug	—	12	—	Cm	Ls	9–20–62	11	—	D	530	14

[1] Date of field analysis measurement is the same as shown for static water-level.

Table 9. *Record of wells*—Continued

Well location number	Owner	Driller	Date completed	Altitude above sea-level (feet)	Method of construction	Diameter of casing (inches)	Total depth (feet)	Depth to bottom of casing (feet)	Aquifer: Name	Aquifer: Composition	Static water-level: Date measured	Static water-level: Depth below land-surface (feet)	Specific capacity (gpm per foot)	Use	Water quality (Field analysis)[1]: Specific conductance (micromhos at 25°C)	Water quality (Field analysis)[1]: Hardness as $CaCO_3$ (grains per gallon)
4	Mrs. Amos Newcombe	—	—	—	Drl	—	—	—	Cbssc	Dol and Ls	9–20–62	36	—	D	625	18
5	Mrs. Elizabeth Newcomer	—	—	—	Dug	—	36	—	Cbssc	Dol and Ls	9–20–62	26	—	D	1200	30
6	do.	—	—	—	Drl	6	46	—	Cbssc	Dol and Ls	9–20–62	19	1.2	S	450	11
7	Joseph A. Hook	—	1870	—	Dug	—	34	—	Cm	Ls	9–28–62	32	—	D, S	550	13
8	do.	R. Myers' Sons, Inc.	1941	—	Drl	—	120 R	—	Cm	Ls	9–28–62	32	1.6	D, S	525	13
9	Henry Ehy	—	—	—	Dug	—	29	—	Chssc	Dol and Ls	10– 1–62	28	—	U	—	—
10	E. W. Wissler	Gill	1930	—	Drl	6	150 R	—	Cbssc	Dol and Ls	10– 1–62	67	.1	D, S	710	18
11	do.	—	—	—	Dug	—	35	—	Cbssc	Dol and Ls	10– 1–62	24	—	U	—	—
12	J. Newcomer	—	—	—	Dug	—	—	—	Cm	Ls	10– 1–62	16	—	D, S	640	17
13	—	—	—	—	Drl	6	—	—	Chssc	Dol and Ls	10– 1–62	32	—	U	625	17
14	Eshelman's Quarry	—	—	—	Drl	6	—	—	Cbssc	Dol and Ls	10– 1–62	22	—	C	610	16
628–1	Engel Bros.	R. Myers' Sons, Inc.	1957	—	Drl	6	190 R	20	Cm	Ls	9–20–62	42	.21	D, S	600	18
2	do.	—	1850	—	Dug	—	35	—	Cm	Ls	9–20–62	19	—	U	—	—
3	Ralph S. Martin	—	—	—	Drl	6	—	—	Cm	Ls	9–20–62	48	—	D, S	450	11
4	Mrs. Henry Engel	Herr The Pump Man	—	—	Drl	6	—	—	Cm	Ls	9–20–62	47	—	D	480	14
5	Paul Newcomer	R. Myers' Sons, Inc.	1932	—	Drl	6	189 R	20	Cm	Ls	9–20–62	62	.12	D, S	780	18
005–628–6	Paul Newcomer	—	—	—	Dug	—	60 R	—	Cm	Ls	9–20–62	33	—	U	—	—
7	J. Newcomer	—	—	—	Dug	—	37	—	Cm	Ls	9–20–62	34	—	D, S	690	20
8	Alhert Hahecker	R. Myers' Sons, Inc.	1937	—	Drl	6	205	—	Cbs	Dol and Ls	9–21–62	91	.07	D, S	750	23
9	do.	—	—	—	Dug	—	63	—	Cbs	Dol and Ls	9–21–62	47	—	U	—	—
629–1	Lloyd Swarr	—	1923	—	Drl	6	160 R	—	Cm	Ls	—	—	—	D, S	750	14
2	Jacob Ginder	—	—	—	Drl	—	55 R	—	Cm	Ls	9–21–62	20 R	—	D	800	21
3	Benjamin Ginder	—	—	—	Dug	—	45	—	Cbs	Dol and Ls	9–21–62	39	—	D, S	460	15
4	Paul Erb	R. Myers' Sons, Inc.	1959	—	Drl	7	141 R	12	Cbs	Dol and Ls	9–21–62	65	—	D, S	1000	28

5	Daniel Stoltzfus	—	—	—	Drl	—	—	—	Cbs	Dol and Ls	9–21–62	64	.08	D, S, Irr	840	26
006–615–1	John H. Shirk	—	1926	—	Drl	5	75 R	—	Czc	Dol	7–17–63	39	1.1	D	700	15
2	Menonite Mission Board	R. Myers' Sons, Inc.	1963	—	Drl	8	110 R	22	Os	Ls	7–19–63	17	7.3	Ps	600	16
616–1	Ira D. Landis	do.	1958	—	Drl	6	200 R	—	Czc	Dol	7–18–63	13	.06	D, S	650	18
617–1	Sanford Leaman	do.	1958	—	Drl	6	—	—	Czc	Dol	7–11–63	38	46	D, S	900	18
2	Witmer Bros.	—	1920	—	Drl	6	126	—	Cl	Dol	7–16–63	11	.17	D, S	760	18
3	Sensennich Corp.	—	1939	—	Drl	8	265 R	—	Os	Ls	8– 5–63	50	.5	I	980	19
618–1	Halbert Brubaker	—	1929	—	Drl	6	57	—	Cl	Dol	7–10–63	34	1.4	D	900	21
2	Martin Erb	R. Myers' Sons, Inc.	1941	—	Drl	6	84 R	—	Czc	Dol	7–11–63	13	.7	D	550	13
619–1	Leon H. Groff	—	1942	—	Drl	—	80 R	—	Cbs	Dol and Ls	6– 9–63	28	.07	D	—	—
2	Charles J. Doerr	—	1920	—	Drl	10	34	—	Cbs	Dol and Ls	7– 8–63	28	.5	D	700	16
620–1	Lloyd R. Vogel	R. Myers' Sons, Inc.	1941	—	Drl	6	144 R	13	Czc	Dol	9–17–63	22	1.3	D	680	14
621–1	McMinn Asphalt	do.	1951	—	Drl	6	80 R	—	Cbs	Dol and Ls	6– 5–63	33	8	C	525	16
622–1	Leroy Hottenstein	—	—	—	Dug	—	—	—	Czc	Dol	10–31–62	28	—	—	—	—
					Drl	—	92 R	—	Czc	Dol	10–31–62	28	—	D, S	1410	27
2	Clarence Metzler	—	—	—	Dug	—	—	—	Czc	Dol	10–31–62	14	—	U	—	—
006–622–3	Clarence Metzler	—	—	—	Dug	—	35	—	Czc	Dol	10–31–62	16	—	D, S	535	13
4	A. S. Root	—	—	—	Dug	—	27	—	Cbs	Dol and Ls	11– 2–62	20	—	D, S	950	18
5	Chester H. Hummer	—	—	—	Dug	—	28 R	—	Cbs	Dol and Ls	11– 2–62	23	—	D	640	12
6	Marvin Hollinger	—	—	—	Dug	—	23	—	Cbs	Dol and Ls	11– 2–62	14	—	D	675	15
7	M. H. Martzall	—	—	—	Dug	—	27	—	Cbs	Dol and Ls	11– 2–62	27	—	U	—	—
8	Willis Kilheffer	R. Myers' Sons, Inc.	1951	—	Drl	6	160 R	—	Czc	Dol	6–10–63	39	.09	D, S	990	23
9	Nora Landis	—	—	—	Drl	6	80	—	Cbs	Dol and Ls	9–17–63	21	.07	D	3000	36
623–1	David G. Wenger	—	—	—	Drl	—	24	—	Cbssc or Czc	Dol and Ls	9–26–62	18	—	D, Irr	—	—
2	do.	—	—	—	Drl	—	—	—	Cbssc or Czc	Dol and Ls	9–26–62	19	—	D, Irr	620	14
3	Henry S. Lehman	—	—	—	Dug	—	—	—	Cbssc	Dol and Ls	9–26–62	30	—	—	—	—
					Drl	—	—	—	Cbssc	Dol and Ls	—	—	—	D	655	16
4	Nelson Cooper	—	—	—	Dug	—	15	—	Czc	Dol	9–26–62	14	—	D	490	13
5	Henry Kettering	—	—	—	Dug	—	26	—	Czc	Dol	9–26–62	21	—	U	790	18

[1] Date of field analysis measurement is the same as shown for static water-level.

Table 9. *Record of wells*—Continued

Well location number	Owner	Driller	Date completed	Altitude above sea-level (feet)	Method of construction	Diameter of casing (inches)	Total depth (feet)	Depth to bottom of casing (feet)	Aquifer: Name	Aquifer: Composition	Static water-level: Date measured	Static water-level: Depth below land-surface (feet)	Specific capacity (gpm per foot)	Use	Water quality (Field analysis)[1]: Specific conductance (micromhos at 25°C)	Water quality (Field analysis)[1]: Hardness as $CaCO_3$ (grains per gallon)
6	Henry Kettering	—	1957	—	Drl	6	—	—	Czc	Dol	9–26–62	21	.05	D, S	945	22
7	do.	—	—	—	Drl	—	—	—	Czc	Dol	—	—	—	D	1150	28
8	do.	—	—	—	Dug	—	26	—	Czc	Dol	9–26–62	18	—	U	—	—
9	Mrs. Clyde Kreider	—	—	—	Drl	—	125	—	Czc	Dol	9–26–62	11	—	D	—	—
10	Clyde Hottenstein	—	1932	—	Drl	6	151	—	Czc	Dol	9–28–62	34	—	S	555	17
11	Edwin Sauder	R. Myers' Sons, Inc.	1957	—	Drl	6	125 R	—	Chssc	Dol and Ls	10–30–62	17	—	U	—	—
12	John B. Noll	—	—	—	Drl	—	220 R	—	Chssc	Dol and Ls	10–30–62	36	—	U	1230	24
13	do.	—	—	—	Drl	6	96 R	—	Chssc	Dol and Ls	10–30–62	33	29	D, S	1480	22
14	do.	—	—	—	Dug	—	36	—	Chssc	Dol and Ls	10–30–62	28	—	U	—	—
15	John F. Cope	—	—	—	Dug	—	27	—	Cbs	Dol and Ls	10–30–62	31	—	U	—	—
16	do.	R. Myers' Sons, Inc.	—	—	Drl	—	63 R	—	Cbs	Dol and Ls	10–30–62	32	—	U	—	—
006–623–17	John F. Cope	R. Myers' Sons, Inc.	—	—	Drl	—	400 R	—	Cbs	Dol and Ls	10–30–62	29	—	O	—	—
18	do.	do.	—	—	Drl	—	450 R	—	Cbs	Dol and Ls	10–30–62	31	—	U	—	—
19	Elam Bollinger	—	—	—	Dug	—	18	—	Czc	Dol	10–31–62	11	—	D	1120	26
20	Daniel Rohrer, Jr.	—	—	—	Dug	—	28	—	Czc	Dol	10–31–62	26	—	D, S	600	15
21	Daniel Lebman	—	—	—	Dug	—	15	—	Czc	Dol	10–31–62	11	—	D, S	690	16
22	Leroy Hottenstein	Martin Fisher	1958	—	Drl	6	142	—	Czc	Dol	10–30–62	22	.11	D, S	440	11
23	do.	—	—	—	Dug	—	27	—	Czc	Dol	10–31–62	18	—	U	1000	23
24	Arthur J. Ulrich	—	1942	—	Drl	6	—	—	Czc	Dol	10–30–62	25	—	D	630	14
624–1	John G. Weidler	—	—	—	Drl	—	204 R	—	Czc	Dol	9–24–62	16	—	D, S	1110	28
2	do.	—	—	—	Dug	—	22	—	Czc	Dol	9–24–62	18	—	U	—	—
3	do.	—	—	—	Drl	—	40 R	—	Czc	Dol	9–24–62	21	—	U	995	28
4	Willis Weaver	—	—	—	Dug	—	17	—	Czc	Dol	9–24–62	12	—	D	625	16

6	Emma Gaul	—	—	—	Dug	—	11	—	Czc	Dol	9–25–62	10	—	D, S	535	14
7	Amos Roland	—	—	—	Dug	—	26	—	Czc	Dol	9–25–62	21	—	D	700	19
8	do.	—	—	—	Dug	—	15 R	—	Czc	Dol	9–25–62	12 R	—	S, Irr	570	15
9	Albert Nissley	—	—	—	Dug	—	24	—	Czc	Dol	9–25–62	22	—	D, S	805	21
10	Mylin Good	—	—	—	Dug	—	44	—	Czc	Dol	9–25–62	28	—	—	—	—
					Drl	—	120 R	—	Czc	Dol	—	—	—	D	755	19
11	do.	—	—	—	Dug	—	—	—	Czc	Dol	—	—	—	—	—	—
					Drl	—	122	—	Czc	Dol	9–25–62	22	—	S	1070	31
12	Kendig Rohrer	R. Myers' Sons, Inc.	1962	—	Drl	—	300 R	—	Cbssc	Dol and Ls	9–25–62	14 R	—	S	555	17
13	do.	—	—	—	Dug	—	16	—	Cbssc	Dol and Ls	9–25–62	13	—	D	615	17
14	J. Robert Eshelman	—	—	—	Dug	—	24	—	Cbssc	Dol and Ls	9–25–62	22	—	D, S	605	16
15	Wm. C. Burkhardt	R. Myers' Sons, Inc.	1947	—	Drl	6	225 R	—	Czc	Dol	9–28–62	23	.05	D	655	16
006–624–16	Charles Sload	R. Myers' Sons, Inc.	1958	—	Drl	6	160 R	15	Czc	Dol	9–28–62	27	—	D	—	—
17	Mrs. Marie Reineare	—	—	—	Drl	—	163	—	Czc	Dol	9–28–62	15	—	U	—	—
18	do.	—	1960	—	Drl	6	—	—	Czc	Dol	9–28–62	25	—	D	640	17
19	Henry Rohrer	—	—	—	Dug	—	37	—	Cbssc	Dol	11– 7–62	35	—	D, S	775	16
20	Gustaf E. Malmborg	—	—	—	Dug	—	16	—	Cbssc	Dol and Ls	11–16–62	8	—	D, Irr	570	15
21	William Dyer	—	—	—	Drl	—	170 R	—	Cbssc	Dol	11–16–62	27	.03	D, S, Irr	770	21
22	do.	—	—	—	Dug	—	37	—	Cbssc	Dol and Ls	11–16–62	10	—	U	—	—
23	Menna W. Heisey	—	—	—	Dug	—	9	—	Cbs	Dol and Ls(?)	11–16–62	5	—	D, S	715	17
625–1	Howard Peifer	R. Myers' Sons, Inc.	—	—	Drl	—	200 R	—	Cbssc	Dol	10–29–62	74	.03	S	980	24
2	Verne Hiestand	H. K. Honberger Sons	1936	—	Drl	6	190 R	—	Cbssc	Dol and Ls	10–30–62	19	.51	D	980	19
3	—	—	—	—	Dug	—	12	—	Cbssc	Dol and Ls	10–30–62	8	—	—	710	16
4	Frank Eshelman	—	—	—	Drl	6	45 R	—	Os	Ls	11–16–62	12	—	S	900	18
5	do.	—	—	—	Dug	—	38	—	Cbssc	Dol	11–19–62	37	—	—	—	—
					Drl	—	175 R	—	Cbssc	Dol	11–19–62	—	—	D, S	680	19
6	Joseph R. Smith	Samuel Kaylor	1959	—	Drl	6	92 R	—	Cbssc	Dol and Ls	11–19–62	11	—	D	525	14
7	Ira Williams	—	—	—	Dug	—	—	—	Cbssc	Dol and Ls	11–19–62	14	—	D	1275	25
8	J. R. Nissley	—	—	—	Dug	—	30	—	Cbssc	Dol	11–19–62	21	—	U	1300	—
9	Weidler Grube	—	—	—	Dug	—	16	—	Cbssc	Dol	11–19–62	12	—	—	690	17
10	Elam Longenecker	—	—	—	Dug	—	38	—	Os	Ls	11–19–62	29	—	D, S	640	15

[1] Date of field analysis measurement is the same as shown for static water-level.

Table 9. *Record of wells*—Continued

Well location number	Owner	Driller	Date completed	Altitude above sea-level (feet)	Method of construction	Diameter of casing (inches)	Total depth (feet)	Depth to bottom of casing (feet)	Aquifer: Name	Aquifer: Composition	Static water-level: Date measured	Static water-level: Depth below land-surface (feet)	Specific capacity (gpm per foot)	Use	Water quality (Field analysis)[1]: Specific conductance (micromhos at 25°C)	Water quality (Field analysis)[1]: Hardness as $CaCO_3$ (grains per gallon)
626–1	Bear Creek Construction Co.	—	—	—	Drl	6	—	—	Cbssc	Dol	10–29–62	41	—	C	580	15
2	Wm. B. Hall	—	—	—	Drl	—	—	—	Cbssc	Dol	10–29–62	27	.04	D	640	18
3	R. C. Steinmetz	—	—	—	Drl	—	240 R	—	Cbssc	Dol and Ls	10–29–62	69	—	D	—	—
4	Enos W. Witmer	—	—	—	Dug	—	—	—	Cbssc	Dol and Ls	10–29–62	19	—	—	—	—
					Drl	—	—	—	Cbssc	Dol and Ls	—	—	—	D	700	17
5	P. Elias Young	H. K. Honberger Sons	1961	—	Drl	—	65 R	—	Cbs	Dol	10–29–62	24	22	D	600	15
006–626–6	I. J. Metzler	—	—	—	Dug	—	31	—	Os	Ls	11–23–62	30	—	U	—	—
7	—	—	—	—	Dug	—	15	—	Os	Ls	11–29–62	13	—	D	640	14
627–1	Paul S. Miller	—	—	—	Dug	—	49	—	Cm	Ls	9–28–62	39	—	D, S	725	14
2	Daniel S. Will	—	—	—	Dug	—	—	—	Cm	Ls	9–28–62	17	—	—	—	—
					Drl	—	—	—	Cm	Ls	9–28–62	17	—	D	700	15
3	Hiram Strickler	R. Myers' Sons, Inc.	1952	—	Dug	—	—	—	Cm	Ls	9–28–62	19	—	—	—	—
					Drl	—	102 R	20	Cm	Ls	9–28–62	19	—	D	900	20
4	do.	—	—	—	Drl	6	—	—	Cm	Dol and Ls(?)	9–28–62	63	.02	D, S	—	—
5	do.	—	—	—	Drl	6	—	—	Cm	Ls	9–28–62	62	—	D, S	740	16
6	do.	R. Myers' Sons, Inc.	1959	—	Drl	6	243 R	20	Cbssc	Dol and Ls	10– 1–62	27	—	D, S	500	11
7	do.	—	—	—	Dug	—	29	—	Cbssc	Dol	10– 1–62	9	—	U	—	—
8	Mrs. Paul L. Weiser	—	—	—	Dug	—	42	—	Cm	Ls	10–29–62	40	—	D, S	600	13
9	Norman Shenk	R. Myers' Sons, Inc.	1961	—	Drl	—	120 R	—	Os	Ls	11–28–62	15	—	Ps	—	—
10	do.	do.	1961	—	Drl	—	125 R	—	Os	Ls	11–28–62	17	—	U	—	—
11	Harold W. Wert	—	—	—	Dug	—	38	—	Os	Ls	11–28–62	34	—	—	—	—
12	J. Roy Breneman	R. Myers' Sons, Inc.	1936	—	Dug	—	43	—	Os	Ls	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

13	do.	—	1957	—	Drl	—	—	—	Os	Ls	11–29–62	29	74	D, S	570	13
628–1	Mark Newcomer	—	1800	—	Dug	—	38	—	Os	Ls	9–28–62	36	—	D, S	750	15
2	Donald Newcomer	—	—	—	Dug	—	65	—	Os	Ls	9–28–62	59	—	U	—	—
3	do.	—	—	—	Drl	—	82	—	Os	Ls	9–28–62	63	4.8	D	700	17
4	Londa Zurin	—	—	—	Dug	—	—	—	Cm	Ls	9–28–62	52	—	U	425	8
5	Harold Long	H. K. Honberger Sons	1956	—	Drl	6	200 R	—	Cm	Ls	9–28–62	33	—	D	600	15
6	Donald Newcomer	—	—	—	Dug	—	62	—	Os	Ls	10– 8–62	58	—	D, S	400	11
7	John S. Haines	—	—	—	Drl	—	—	—	Os	Ls	10–30–62	41	—	D	880	15
006–628–8	Bruce Hiett	R. Myers' Sons, Inc.	1950	—	Drl	6	233 R	23	Os	Ls	11–29–62	57	—	D	590	12
9	J. B. Hostetter	—	—	—	Drl	6	—	—	Oe	Dol and Ls	11–29–62	53	58	D, S	550	13
10	Arthur Horner	—	—	—	Dug	—	53	—	Oe	Dol and Ls	11–29–62	51	—	D, S	420	10
629–1	Joseph Wolgmuth, Jr.	—	—	—	Drl	6	—	—	Cm	Ls	9–19–62	45	—	D, S	870	22
2	J. Sherk	—	—	—	Dug	—	34	—	Oe	Dol and Ls	11–28–62	27	—	—	—	—
					Drl	—	86	—	Oe	Dol and Ls	11–28–62	27	—	U	—	—
3	Richard Oldwiler	R. Myers' Sons, Inc.	1957	—	Drl	—	127 R	8	Oe	Dol and Ls	11–28–62	42	.05	D	730	20
4	Henry E. Shenk	—	—	—	Dug	—	—	—	Oe	Dol and Ls	—	—	—	—	—	—
					Drl	—	31	—	Oe	Dol and Ls	11–28–62	26	—	D, S	550	14
007–615–1	Edward Hess	—	1952	—	Drl	6	—	—	Oe	Dol and Ls	7–19–63	28	130	D, S	650	16
2	Maurice Young	—	1950	—	Drl	6	—	—	Oe	Dol and Ls	7–18–63	32	14	D	560	14
616–1	D. Martin Zimmerman	—	1962	—	Drl	5	110	—	Oe	Dol and Ls	7–16–63	32	.3	D, S	730	16
2	Warren Snyder	H. K. Honberger Sons	1957	—	Drl	6	240 R	—	Oe	Dol and Ls	7–18–63	43	.06	D, S	710	18
618–1	Jacob Toews	R. Myers' Sons, Inc.	1962	—	Drl	6	80 R	30	Oe	Dol and Ls	7–17–63	27	.69	S	580	14
2	R. D. Buckwalter	do.	1952	—	Drl	6	550 R	—	Oe	Dol and Ls	7–21–63	33	.1	D, S	730	25
3	do.	do.	1948	—	Drl	6	275 R	—	Oe	Dol and Ls	7–21–63	26	6	D, S,	—	—
4	Mrs. Helen Thomas	do.	1963	—	Drl	8	101	30	Oe	Dol and Ls	7– 8–63	25	.98	D	560	14
619–1	Enos Good	H. K. Honberger Sons	1962	—	Drl	6	140	20	Oe	Dol and Ls	7–16–63	26	2.8	D, S	600	16
620–1	Henry Delp	Samuel Kaylor	1959	—	Drl	6	143 R	17	Oe	Dol and Ls	7–16–63	40 R	—	D	950	18
2	Dale L. Landis	R. Myers' Sons, Inc.	1962	—	Drl	6	60 R	—	Os	Ls	6– 6–63	37	1.7	D, S	525	16
3	Ivan Snyder	do.	1956	—	Drl	6	195 R	—	Oe	Dol and Ls	—	—	—	D, S	625	16
621–1	Willis Peifer	do.	1958	—	Drl	6	122 R	20	Oe	Dol and Ls	7–15–63	19	65	D	500	13
2	Daniel Martin	H. K. Honberger Sons	1958	—	Drl	6	140 R	—	Oe	Dol and Ls	7–17–63	31	.51	D, S	600	12
622–1	Elam Landis	—	—	—	Dug	—	36	—	Os	Ls	11– 5–62	33	—	D, S	325	8

[1] Date of field analysis measurement is the same as shown for static water-level.

Table 9. *Record of wells*—Continued

Well location number	Owner	Driller	Date completed	Altitude above sea-level (feet)	Method of construction	Diameter of casing (inches)	Total depth (feet)	Depth to bottom of casing (feet)	Aquifer: Name	Aquifer: Composition	Static water-level: Date measured	Static water-level: Depth below land-surface (feet)	Specific capacity (gpm per foot)	Use	Water quality (Field analysis)[1]: Specific conductance (micromhos at 25°C)	Water quality (Field analysis)[1]: Hardness as $CaCO_3$ (grains per gallon)
2	Clarence Landis	—	—	—	Drl	6	51	—	Os	Ls	11- 5-62	37	—	D	550	12
007-622-3	G. Longenecker	—	—	—	Drl	—	74	—	Os	Ls	11- 5-62	35	—	U	—	—
4	do.	R. Myers' Sons, Inc.	1952	—	Drl	6	120 R	—	Os	Ls	11- 5-62	38	12	D, S	540	12
5	Mary Grayle	Sam Kaylor	—	—	Drl	6	200 R	—	Oe	Dol and Ls	11- 5-62	34	—	D, S	525	13
6	do.	—	—	—	Dug	—	35	—	Oe	Dol and Ls	11- 5-62	30	—	U	—	—
7	A. H. Whistler	R. Myers' Sons, Inc.	—	—	Drl	6	—	—	Oe	Dol and Ls	11- 6-62	44	.3	D, Irr	840	14
8	Aaron L. Martin	do.	1961	—	Drl	6	120 R	—	Oe	Dol and Ls	11-15-62	28	1.5	D, S	—	—
9	do.	—	—	—	Drl	6	58	—	Oe	Dol and Ls	11-15-62	27	—	U	—	—
10	Menna W. Hoffer	—	—	—	Dug	—	27	—	Oe	Dol and Ls	11-15-62	21	—	D, S	735	18
11	Edward Nixdorf	—	—	—	Drl	6	125	—	Oe	Dol and Ls	6- 6-63	28	.33	D, S	600	15
623-1	Clarence Keener, Jr.	—	—	—	Drl	—	—	—	Os	Ls	11-14-62	32	.07	D, S	575	14
2	Annamae Hausman	—	—	—	Dug	—	21	—	Os	Ls	11- 7-62	18	—	D	660	13
3	do.	R. Myers' Sons, Inc.	1914	—	Drl	6	75 R	—	Os	Ls	11- 7-62	8	—	D	650	15
4	Titus Nolt	—	—	—	Dug	—	23	—	Oe	Dol and Ls	11- 9-62	17	—	Irr	680	17
5	Robert N. Miller	—	—	—	Dug	—	18	—	Oe	Dol and Ls	11- 9-62	16	—	D	570	15
6	John L. Cassel	R. Myers' Sons, Inc.	1946	—	Drl	6	128 R	—	Oe	Dol and Ls	11-14-62	14	2.5	C	690	18
7	do.	—	—	—	Dug	—	22	—	Oe	Dol and Ls	11-14-62	15	—	D	655	15
624-1	John Cope	—	—	—	Dug	—	21	—	Cbssc	Dol and Ls	11- 6-62	19	—	D	380	9
2	Henry W. Stauffer	—	—	—	Dug	—	15	—	Os	Ls	11- 6-62	12	—	D, S	610	15
3	Mervin Hess	—	—	—	Dug	—	12	—	Os	Ls	11- 6-62	10	—	—	—	—
					Drl	6	59	—	Os	Ls	11- 6-62	11	—	D, S	700	13
4	Amos Sauder	—	—	—	Dug	—	26	—	Cbssc	Dol and Ls	11- 6-62	23	—	D, S	890	16
5	John M. Becker	—	—	—	Dug	—	27	—	Oe	Dol and Ls	11- 7-62	24	—	D	550	13

7	do.	—	—	—	Dug	—	17	—	Os	Ls	11- 7-62	14	—	U	—	—
007-624-8	Clayton R. Nissley	—	—	—	Dug	—	16	—	Os	Ls	11- 7-62	13	—	D, S	600	15
9	Leroy Esbenshade	—	—	—	Drl	6	180 R	—	Oe	Dol and Ls	11- 9-62	20	.93	S	2300	—
10	Lucy C. Gross Trust Estate	R. Myers' Sons, Inc.	1930	—	Drl	6	170 R	—	Oe	Dol and Ls	11- 9-62	18	—	D	640	15
11	do.	—	—	—	Dug	—	22	—	Oe	Dol and Ls	11- 9-62	16	—	U	—	—
12	do.	—	—	—	Dug	—	23	—	Oe	Dol and Ls	11- 9-62	20	—	S	650	16
13	Harry Becker	—	—	—	Dug	—	18	—	Oe	Dol and Ls	11-14-62	15	—	U	—	—
625-1	John N. Metzler	—	1945	—	Drl	—	306 R	—	Os	Ls	11- 7-62	22	—	D, S	525	14
2	Mrs. John Eby	R. Myers' Sons, Inc.	1943	—	Drl	6	98 R	—	Oe	Dol and Ls	11-15-62	26	—	D, S	590	13
3	do.	do.	1957	—	Drl	6	67 R	—	Oe	Dol and Ls	11-15-62	23	8.5	Irr	570	13
4	Leon Schnupp	—	—	—	Dug	—	32	—	Oe	Dol and Ls	11-15-62	26	—	U	740	14
5	Wilmer Esbenshade	R. Myers' Sons, Inc.	—	—	Drl	6	>600 R	200	Oe	Dol and Ls	11-16-62	105	—	D, S	740	17
6	do.	—	—	—	Dug	—	54	—	Oe	Dol and Ls	11-16-62	40	—	Irr	945	19
7	do.	—	—	—	Dug	—	58	—	Oe	Dol and Ls	11-16-62	39	—	—	—	—
					Drl	—	176	—	Oe	Dol and Ls	11-16-62	39	—	U	—	—
8	John N. Metzler	—	—	—	Dug	—	35	—	Oe	Dol and Ls	11-16-62	32	—	D, S	500	12
9	Harold Witmer	—	—	—	Dug	—	20	—	Os	Ls	11-19-62	16	—	D, S	500	13
10	Howard Brubaker	R. Myers' Sons, Inc.	—	—	Drl	6	60 R	—	Os	Ls	11-19-62	44	—	D, S	400	9
11	Pennsylvania State University	—	—	—	Dug	—	25	—	Os	Ls	11-19-62	20	—	D	—	—
12	do.	—	—	—	Drl	—	—	—	Os	Ls	11-19-62	20	—	Irr	620	14
626-1	J. Earl Witmer	R. Myers' Sons, Inc.	1961	—	Drl	6	160 R	—	Os	Ls	11-19-62	24	—	D	790	22
2	E. Witmer	—	—	—	Dug	—	34	—	Oe	Dol and Ls	11-21-62	30	—	U	549	11
3	do.	—	—	—	Drl	—	—	—	Oe	Dol and Ls	11-21-62	47	—	D, S	660	14
4	Jacob H. Harnish	—	1907	—	Drl	6	180	—	Oe	Dol and Ls	11-21-62	34	—	U	—	—
5	Nissley Erb	—	1906	—	Drl	6	80 R	—	Oe	Dol and Ls	11-21-62	37	8.7	D, S	650	14
6	C. Robert Fry	R. Myers' Sons, Inc.	1957	—	Drl	6	150 R	—	Oe	Dol and Ls	11-21-62	44	—	D, I	630	15
007-626-7	H. Henry Martin	—	—	—	Dug	—	42	—	Oe	Dol and Ls	11-21-62	41	—	—	1140	22
					Drl	—	200 R	—	Oe	Dol and Ls	11-21-62	41	—	D, S	—	—
627-1	Roy Henny	—	—	—	Dug	—	40	—	Oe	Dol and Ls	11-21-62	33	—	U	—	—
2	do.	R. Myers' Sons, Inc.	—	—	Drl	—	238	—	Oe	Dol and Ls	11-21-62	26	—	U	—	—
3	Lester Gehman	—	—	—	Dug	—	48	—	Oe	Dol and Ls	11-21-62	37	—	U	—	—
4	Henry L. Shelley	—	1930	—	Drl	—	156	—	Oe	Dol and Ls	11-23-62	49	.05	D, S	550	12
5	Henry E. Shenk	—	—	—	Dug	—	44	—	Oe	Dol and Ls	11-23-62	39	—	D, S	625	13

[1] Date of field analysis measurement is the same as shown for static water-level.

Table 9. *Record of wells*—Continued

Well location number	Owner	Driller	Date completed	Altitude above sea-level (feet)	Method of construction	Diameter of casing (inches)	Total depth (feet)	Depth to bottom of casing (feet)	Aquifer: Name	Aquifer: Composition	Static water-level: Date measured	Static water-level: Depth below land-surface (feet)	Specific capacity (gpm per foot)	Use	Water quality (Field analysis)[1]: Specific conductance (micromhos at 25°C)	Water quality (Field analysis)[1]: Hardness as $CaCO_3$ (grains per gallon)
6	J. Harold Esbenshade	R. Myers' Sons, Inc.	—	—	Dug	—	43	—	Oe	Dol and Ls	11-23-62	41	—	—	—	—
					Drl	6	180 R	—	Oe	Dol and Ls	11-23-62	56	600	D, S	635	13
7	Leroy Kopp	—	—	—	Dug	—	42	—	Oe	Dol and Ls	11-23-62	25	—	U	—	—
8	Henry Miller	—	—	—	Dug	—	42	—	Oe	Dol and Ls	11-23-62	38	—	D, S	500	12
9	Harry K. Shenk	—	—	—	Dug	—	44	—	Oe	Dol and Ls	11-26-62	33	—	U	—	—
628-1	Harry Musser, Jr.	H. K. Honberger Sons	—	—	Dug	—	68	—	Oe	Dol and Ls	11-26-62	47	—	—	—	—
					Drl	—	100 R	—	Oe	Dol and Ls	11-26-62	47	—	S, Irr	—	—
2	do.	R. Myers' Sons, Inc.	1958	—	Drl	6	—	—	Oe	Dol and Ls	11-26-62	62	—	D, S	515	12
3	do.	do.	1962	—	Drl	5	203	—	Oe	Dol and Ls	11-26-62	58	.18	U	500	—
4	Levi Snyder	—	—	—	Dug	—	62	—	Oe	Dol and Ls	11-26-62	60	—	D, S	460	10
5	Benjamin S. Ebersole	—	—	—	Drl	6	94 R	—	Oe	Dol and Ls	11-26-62	65	—	D	580	14
6	Jonas B. Brubaker	—	—	—	Drl	—	216 R	—	Oe	Dol and Ls	11-26-62	49	—	U	280	6
7	W. S. Carter	H. K. Honberger Sons	1942	—	Drl	6	—	65	Oe	Dol and Ls	11-26-62	35	—	D	400	10
8	Amos N. Shelley	R. Myers' Sons, Inc.	—	—	Drl	6	80 R	—	Oe	Dol and Ls	11-27-62	37	—	D, S	555	14
9	do.	—	—	—	Dug	—	59	—	Oe	Dol and Ls	11-26-62	37	—	U	—	—
12	Clarence Douple	R. Myers' Sons, Inc.	1948	—	Drl	—	120 R	—	Oe	Dol and Ls	11-27-62	37	—	D	705	13
13	Gruber Bros.	—	—	—	Dug	—	64	—	Oe	Dol and Ls	11-27-62	50	—	—	690	16
					Drl	—	—	—	Oe	Dol and Ls	11-27-62	50	—	D, S	—	—
14	Roy Sauder	—	—	—	Dug	—	54	—	Oe	Dol and Ls	11-27-62	49	—	U	—	—
629-1	David G. Miller	—	—	—	Dug	—	22	—	Oe	Dol and Ls	11-27-62	21	—	D, S	500	12
007-629-2	James Garber	—	—	—	Drl	—	168 R	—	Oe	Dol and Ls	11-28-62	28	.04	S	810	20
3	J. B. Hostetter	—	—	—	Drl	6	—	—	Oe	Dol and Ls	11-28-62	20	—	U	—	—
4	do.	—	—	—	Drl	—	25 R	—	Oe	Dol and Ls	11-28-62	11	1.6	D, S	505	12

618–1	Paul Coble	—	1959	—	Drl	6	200 R	—	Cbssc	Dol and Ls	6–28–63	41	.05	D	510	15
619–1	Lanco	—	1945	—	Drl	6	135 R	—	Oe	Dol and Ls	7–17–62	37	.1	C	630	18
2	Earl Minnich	R. Myers' Sons, Inc.	1955	—	Drl	6	180 R	—	Cm	Ls	8–15–63	39	.5	D. S	700	15
620–1	John D. Burkholder	do.	1959	—	Drl	6	100 R	—	Cbssc	Dol and Ls	6–27–63	44	.97	D, S	550	15
2	Alfred Longer	—	1951	—	Drl	6	—	—	Oe	Dol and Ls	7–15–63	38	1.2	D	670	16
622–1	Ivan Hoover	—	—	—	Drl	6	—	—	Oe	Dol and Ls	7–15–63	42	.05	D, S	520	14
623–1	John K. Cassel	—	—	—	Dug	—	29	—	Oe	Dol and Ls	11– 9–62	26	—	U	—	—
2	A. H. Weidman	R. Myers' Sons, Inc.	1924	—	Drl	6	98 R	—	Oe	Dol and Ls	11– 9–62	21	—	D	525	15
3	do.	—	—	—	Dug	—	27	—	Oe	Dol and Ls	11– 9–62	24	—	U	—	—
4	Manheim Auto Auction	—	—	—	Drl	6	160 R	—	Oe	Dol and Ls	11–14–62	23	—	C	490	13
5	Kauffman Mennonite Church	—	—	—	Dug	—	35	—	Oe	Dol and Ls	11–14–62	23	—	D, S	800	18
6	do.	—	1961	—	Drl	6	<100 R	—	Oe	Dol and Ls	11–14–62	27	—	D	710	18
7	Paul G. Brubaker	—	—	—	Dug	—	23	—	Oe	Dol and Ls	11–15–62	14	—	D, S	370	9
624–1	John K. Cassell	R. Myers' Sons, Inc.	—	—	Drl	6	180 R	20	Oe	Dol and Ls	11–14–62	10	1.7	Ps, S	570	13
2	do.	—	—	—	Dug	—	14	—	Oe	Dol and Ls	11–14–62	5	—	U	—	—
3	do.	—	—	—	Dug	—	11	—	Oe	Dol and Ls	11–14–62	6	—	Irr	690	19
626–1	Andrew N. Miller	R. Myers' Sons, Inc.	1957	—	Drl	6	150 R	12	Oe	Dol and Ls	11–15–62	39	13	D, S	575	16
2	do.	—	—	—	Dug	—	56	—	Oe	Dol and Ls	11–15–62	42	—	U	—	—
3	Isaac Garman	—	—	—	Drl	—	59	—	Oe	Dol and Ls	11–21–62	32	—	D, S	520	11
008–626–4	Isaac Garman	—	—	—	Dug	—	44	—	Oe	Dol and Ls	11–21–62	34	—	U	—	—
5	Katie Hoover	—	—	—	Drl	6	—	—	Oe	Dol and Ls	11–23–62	25	.15	D, S	600	14
009–615–1	Alan Balmer	R. Myers' Sons, Inc.	1948	—	Drl	6	265 R	35	Cr	Dol and Ls	7–25–63	48	.03	D	—	—
2	Harold Spangler	—	1941	—	Drl	6	101 R	—	Cr	Dol and Ls	7–26–63	22	.35	D, S	650	17
616–1	Richard Hess	Aaron Martin	1953	—	Drl	6	240 R	—	Oe	Dol and Ls	7–22–63	72	.05	S	600	14
2	Titus B. Martin	—	—	—	Drl	6	—	—	Cr	Dol and Ls	7–22–63	39	6.3	D, S	450	10
617–1	George Miles	—	1951	—	Drl	6	70 R	—	Oe	Dol and Ls	7–26–63	29	1.8	D	—	—
2	Samuel Kulp	R. Myers' Sons, Inc.	1950	—	Drl	6	135 R	—	Cr	Dol and Ls	8– 1–63	9	.14	Ps	530	12
3	Animal Trap Co.	—	—	—	Drl	8	27 R	—	Os	Ls	8– 2–63	6	350	I	620	13
618–1	Robert Risser	R. Myers' Sons, Inc.	1961	—	Drl	6	132 R	—	Oe	Dol and Ls	7–29–63	19	.14	D	540	13
2	Morgan Paper Co.	—	1930	—	Drl	—	42 R	—	Os	Ls	—	—	—	I	550	12
3	do.	R. Myers' Sons, Inc.	1942	—	Drl	10	123 R	12	Os	Ls	—	6 R	—	I	550	13
4	Lititz Water Co.	—	—	—	Dug	—	27 R	—	Os	Ls	—	23 R	—	Ps	—	—

[1] Date of field analysis measurement is the same as shown for static water-level.

Table 9. *Record of wells*—Continued

Well location number	Owner	Driller	Date completed	Altitude above sea-level (feet)	Method of construction	Diameter of casing (inches)	Total depth (feet)	Depth to bottom of casing (feet)	Aquifer: Name	Aquifer: Composition	Static water-level: Date measured	Static water-level: Depth below land-surface (feet)	Specific capacity (gpm per foot)	Use	Water quality (Field analysis)[1]: Specific conductance (micromhos at 25°C)	Water quality (Field analysis)[1]: Hardness as $CaCO_3$ (grains per gallon)
5	Lititz Water Co.	—	—	—	Drl	10	91 R	—	Os	Ls	—	33 R	500	Ps	—	—
6	do.	—	—	—	Drl	10	66 R	—	Os	Ls	—	6 R	400	Ps	515	—
7	do.	—	—	—	Drl	10	118 R	—	Os	Ls	—	—	500	Ps	—	—
8	Paul Enck, Jr.	R. Myers' Sons, Inc.	1962	—	Drl	6	86 R	—	Oe	Dol and Ls	8–20–63	44	.05	D	480	11
9	Scott Garman	do.	1960	—	Drl	6	62 R	—	Oe	Dol and Ls	8–20–63	53	72	D	500	11
619–1	John B. Kendig, Jr.	—	—	—	Drl	6	—	—	Cm	Ls	6–28–63	44	.54	D, Irr	650	16
2	Joseph Burkholder	—	—	—	Dug	—	—	—	Oe	Dol and Ls	—	—	—	—	—	—
					Drl	6	—	—	Oe	Dol and Ls	7–12–63	42	.4	D, S	500	14
620–1	Carl Longenecker	—	1943	—	Drl	6	90 R	—	Os	Ls	6–25–63	33	.15	D, S	690	19
2	Paul E. Balmer	R. Myers' Sons, Inc.	1953	—	Drl	6	90 R	20	Os	Ls	6–25–63	42	16	D, S	800	20
3	Frank Earhart	—	—	—	Dug	—	—	—	Oe	Dol and Ls	7–12–63	60	—	—	—	—
					Drl	6	—	—	Oe	Dol and Ls	7–12–63	61	.07	D, S	600	17
621–1	Paul Sauder	—	1957	—	Drl	6	100 R	—	Os	Ls	6–26–63	38	30	D, S	—	—
009–622–1	Clarence Keener	—	1937	—	Drl	6	145 R	—	Oe	Dol and Ls	7–11–63	27	.06	D, S	830	19
2	do.	R. Myers' Sons, Inc.	1956	—	Drl	7	265 R	—	Oe	Dol and Ls	1956	35 R	—	Irr	1100	22
623–1	David Moseman	do.	1956	—	Drl	6	200 R	—	Os	Ls	7–11–63	30	6	C	—	—
2	U.S. Asbestos Co.	—	1954	—	Drl	8	300 R	32	Os	Ls	—	—	—	I	—	—
3	do.	—	—	—	Drl	—	312 R	—	Os	Ls	—	—	—	I	—	—
4	do.	R. Myers' Sons, Inc.	1961	—	Drl	8	42 R	24	Os	Ls	—	—	150	I	—	—
010–615–1	Adam Oberholtzer	do.	1954	—	Drl	6	81 R	6	Os	Ls	7–25–63	21	1.9	D	1100	23
2	Ira Good	—	—	—	Drl	6	—	—	Oe	Dol and Ls	8–14–63	12	3.8	D, S	600	13
618–1	R. W. Sauder	—	—	—	Drl	6	100 R	—	Oe	Dol and Ls	7–29–63	42	.48	I	730	17
619–1	Ira Hess	—	1955	—	Drl	6	145 R	—	Oe	Dol and Ls	6–26–63	49	.20	D	510	17
620–1	Erbs Mennonite Church	M. A. Stoltzfuss	—	—	Drl	8	120 R	—	Oe	Dol and Ls	6–25–63	55	1.9	Ps	550	18

621–1	J. Robert Shenk	—	—	—	Drl	6	150 R	—	Oe	Dol and Ls	6–26–63	47	1.6	D, S	—	—
622–1	Noah Kreider & Sons	R. Myers' Sons, Inc.	1957	—	Drl	8	300 R	22	Oe	Dol and Ls	—	17 R	—	Irr	600	16
011–615–1	Melvin Oberholtzer	Samuel Kaylor	1962	—	Drl	6	270 R	30	Os or Oe	Ls or Dol and Ls	—	—	.06	D, S	550	14
2	Edward H. Bollinger	—	—	—	Drl	—	—	—	Oe	Dol and Ls	8–15–63	83	.03	D, S	530	12
616–1	Paul B. Martin	R. Myers' Sons, Inc.	1963	—	Drl	6	142 R	21	Oo or Oa	Dol or Ls	8–14–63	20	.16	D, S	560	13
2	Jacob Holsinger	Grant	1962	—	Drl	6	95 R	—	Omy	Ls	8–19–63	12	.2	U	660	15
012–615–1	Alvin W. Adams	R. Myers' Sons, Inc.	1959	—	Drl	6	156 R	—	Oe	Dol and Ls	7–31–63	57	.04	D	550	11
2	Titus Martin	do.	1960	—	Drl	6	42 R	—	Oe	Dol and Ls	8– 2–63	12	74	D	500	10
3	Irwin Martin	—	—	—	Drl	6	240 R	—	Oe	Dol and Ls	8– 2–63	76	.27	D, S	660	15
616–1	Melvin Brumbach	—	1925	—	Drl	6	102 R	—	Oe	Dol and Ls	7–31–63	23	.2	D, S	480	12
2	Elam Shirk	Robert Grant	1959	—	Drl	6	260 R	40	Oe	Dol and Ls	8–14–63	52	.04	D, S	540	11
617–1	Charles W. Loose	—	—	—	Drl	6	—	—	Oo	Dol	8– 1–63	9	.10	D	—	—
013–615–1	Edward Stahl	John and Alan Mays	1960	—	Drl	6	62 R	62	Oo	Dol	7–31–63	10	2.2	I	520	13

[1] Date of field analysis measurement is the same as sbown for static water-level.

Table 10. *Record of springs*

Use: C, commercial; D, domestic; Irr, irrigation; Ps, public supply; S, stock; U, unused.

Spring location number	Owner	Topographic position	Estimated yield (gpm)	Use	Water Quality (Field analysis): Date measured	Specific conductance (micromhos at 25°C)	Hardness as $CaCo_3$ (grains per gallon)
003–625–A	Latan Heisey	Valley floor	—	D, S	10–24–62	250	5
626–A	Ray Rice	do.	—	C	10–24–62	340	8
004–620–A	Willis Esbenshade	Head of draw	—	D, S	6–17–63	460	10
624–A	East Hempfield Water Authority	Valley floor	300	Ps	10–22–62	300	7
626–A	R. B. Nolt	do.	—	S	10–5–62	—	—
627–A	John Melhorn	do.	10	D, S	9–24–62	640	19
628–A	Rebecca Heisey	do.	—	D, S	10–10–62	630	15
005–623–A	Amos R. Herr	do.	2	D, S	10–26–62	580	13
626–A	Raymond Hess	do.	—	S	10–5–62	440	10
626–B	B. B. Brannerman Estate	Hillside	—	D, S	10–8–62	550	14
626–C	Wilbur Heistand	Valley floor	—	D, S	10–8–62	675	15
627–A	James Newcomer	do.	55	D, S	9–24–62	475	14
629–A	Alvin Reist	do.	10	D, S	9–21–62	490	15
006–619–A	East Petersburg Water Authority	do.	200	Ps	6–6–63	570	16
622–A	Clarence Metzler	do.	10	D, S, Irr	10–31–62	400	10
623–A	Elam Bollinger	Hillside	—	S	10–31–62	655	18
624–A	Hottenstein Bros.	do.	—	D	9–28–62	525	12
624–B	Menno W. Heisey	Valley floor	—	Irr	11–16–62	560	13
007–619–A	Ivan H. Snyder	do.	3	D, S	5–31–63	520	12
624–A	John H. Metzler	do.	—	U	11–7–62	525	15
629–A	James Ganber	Head of draw	—	D	11–28–62	340	8

Table 11. *Chemical analyses of ground water in the Lancaster quadrangle*

(Results in parts per millions except as indicated)

Well or spring location number	Date of collection	Temperature (°F)	Silica (SiO_2)	Total iron (Fe)	Total Manganese (Mn)	Calcium[1] (Ca)	Magnesium[1] (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate[2] (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Specific conductance (micromhos at 25°C)	pH[2]
Lancaster County																			
)0-615-2	10-16-63	54	10	1.2	0.00	117	19	9.1	2.4	253	78	26	0.2	78	481	370	163	742	7.26
616-1	10-16-63	54.5	9.6	.04	.01	94	16	29	2.4	224	32	62	.1	73	459	300	117	741	7.53
616-1	4-23-64	54.5	8.5	.02	.00	94	16	14	1.5	213	40	36	.0	85	425	301	127	688	7.47
620-2	10-17-63	54.5	11	.08	.00	118	29	18	3.2	376	77	29	.1	11	496	415	109	804	7.24
622-1	5-6-65	54	11	.02	.00	96	9.4	4.5	1.0	224	40	14	.0	37	331	278	95	528	7.46
625-1	5-14-65	55	9.8	.01	.00	68	7.9	5.5	1.9	187	12	11	.0	38	260	202	49	416	7.47
627-1	5-10-65	55	12	.08	.00	128	17	26	19	338	44	62	.0	92	608	390	113	944	7.17
627-2	6-19-63	57	12	.10	.00	91	12	5.6	1.5	157	52	24	.2	95	398	274	146	588	7.29
)1-621-1	5-14-65	55	12	.05	.00	107	26	27	2.7	191	89	70	.0	60	501	375	218	793	7.47
622-1	6-20-63	55	13	.18	.00	128	17	7.8	1.5	286	85	17	.1	59	494	387	157	758	7.23
623-1	6-19-63	54	13	.16	.00	136	22	17	6.0	250	77	46	.0	142	601	430	229	926	7.14
)2-615-1	10-24-63	54.5	8.2	.23	.03	164	54	26	34	351	167	59	.1	212	919	630	346	1,380	7.21
619-1	10-17-63	57	14	.06	.03	142	18	32	4.3	347	93	44	.1	62	586	430	148	941	7.05
-2	10-18-63	54	10	.14	.03	133	21	16	2.2	396	84	20	.1	17	505	420	98	810	7.14
623-2	6-20-63	55	12	.13	.00	75	11	3.4	3.0	210	39	9.2	.1	18	277	232	60	467	7.32
623-2	5-13-65	53	12	.00	.00	80	11	4.0	3.0	231	32	12	.1	20	290	244	55	481	7.50
)3-615-2	10-16-63	54	7.1	.07	.13	62	37	4.3	3.4	294	22	9.8	.0	57	342	306	69	582	7.46
616-1	10-16-63	55	8.2	.06	.01	67	32	5.0	1.6	296	46	13	.1	9.8	330	300	58	570	7.57
-2	10-15-63	53	8.5	.10	.01	83	54	19	4.1	403	50	27	.0	39	476	430	100	815	7.34
)4-616-1	10-24-63	54.5	9.3	.10	.03	60	35	2.6	2.1	331	23	4.2	.2	.3	305	294	23	523	7.55
)4-616-1	4-23-64	53.5	8.8	.12	.00	59	33	3.5	2.0	330	25	3.3	0.0	1.2	299	283	14	545	7.61

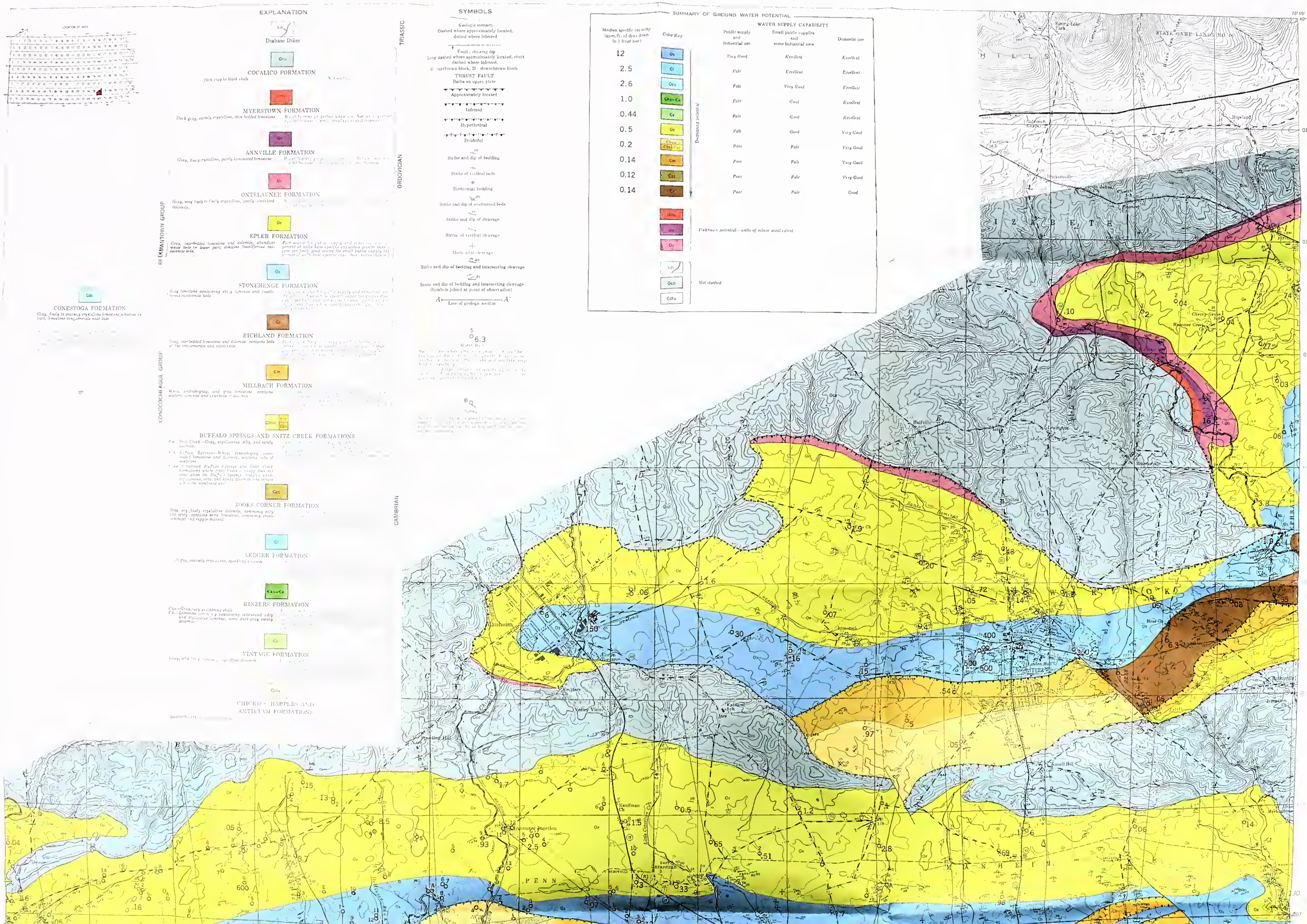
Table 11. *Chemical analyses of ground water in the Lancaster quadrangle*—Continued

(Results in parts per millions except as indicated)

Well or spring location number	Date of collection	Temperature (°F)	Silica (SiO_2)	Total iron (Fe)	Total Manganese (Mn)	Calcium[1] (Ca)	Magnesium[1] (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate[2] ($(HCO)_3$)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Specific conductance (micromhos at 25°C)	pH_2
Lancaster County																			
617–3	10–15–63	53.5	7.9	.25	.11	72	40	6.2	2.0	311	64	19	.1	.5	363	344	90	[2]650	7.53
618–1	10–23–63	55	6.3	.09	.11	95	51	24	5.0	408	98	36	.0	28	554	448	118	[2]925	7.32
618–1	4–15–64	55	7.9	.04	.00	94	49	22	7.0	402	95	35	.0	36	556	436	111	923	7.30
624–3	3–25–63	54.5	7.8	.00	.00	45	22	5.4	1.5	193	11	16	.0	22	253	204	48	410	7.86
624–3	5–13–65	54	8.8	.08	.00	59	32	44	2.8	233	14	114	.0	11	408	280	88	760	7.68
626–2	4–3–63	54	9.6	.05	.03	60	25	2.4	1.5	243	26	6.4	.0	26	280	257	55	525	7.68
628–7	4–18–63	56.5	8.2	.07	.00	66	39	18	1.0	298	32	34	.0	48	394	321	88	732	7.67
005–620–1	10–9–63	56	8.2	.08	.11	72	39	4.0	2.0	279	51	16	.1	46	379	340	114	[2]675	7.47
620–1	4–15–64	58	7.6	.02	.00	72	39	6.7	7.0	306	61	18	.0	35	412	340	90	670	7.34
621–1	10–9–63	55	7.3	.09	.13	48	22	3.0	1.0	189	6	7.2	.0	39	234	212	55	[2]425	7.86
621–1	4–16–64	54	6.6	.02	.00	42	21	3.0	4.0	188	7.6	7.4	.0	39	240	192	38	413	7.67
622–2	5–18–65	55	9.0	.01	.00	114	72	36	100	594	77	102	.0	127	1,020	580	94	1,510	7.08
623–2	4–4–63	56	7.7	.05	.00	58	24	5.6	1.8	236	28	11	.1	22	298	241	53	520	7.83
–13	4–3–63	54.5	8.2	.27	.02	58	39	1.4	6.0	291	28	4.6	.0	26	325	293	73	545	7.75
626–3	5–13–65	55	7.9	.00	.00	69	36	4.8	4.5	304	49	11	.1	29	363	320	71	607	7.47
629–A	3–25–63	53	8.5	.17	.02	48	7.3	4.7	2.5	114	26	9.2	.0	25	195	140	60	310	7.72
006–617–1	10–3–63	54	8.8	.07	.06	80	45	12	32	309	60	33	.1	102	568	384	134	[2]900	7.30
617–1	4–16–64	53.5	7.3	.02	.00	59	32	7.0	24	245	40	24	.2	69	414	279	79	658	7.31
624–21	4–18–63	56	11	.13	.02	79	37	12	7.0	321	80	17	.0	13	409	343	91	732	7.64
006–624–21	5–18–65	55	11	0.02	0.00	80	38	9.8	6.1	346	75	17	0.4	8.0	405	360	73	689	7.58
627–4	4–17–63	54	7.7	.03	.00	87	33	5.6	14	338	61	14	.7	14	424	352	80	742	7.49

627–4	5–17–65	55	9.2	.11	.00	96	33	7.2	15	368	67	20	.5	25	—	376	74	[2]840	7.47
627–13	5–10–65	54	8.2	.00	.00	96	12	3.8	2.0	257	20	9.2	.0	34	305	290	79	513	7.46
628–3	5–12–65	54	11	.05	.00	118	15	13	2.3	359	14	17	.0	56	432	355	62	695	7.07
628–9	5–12–65	54	7.9	.01	.01	77	9.7	4.9	1.5	224	18	15	.0	27	275	232	49	466	7.42
7–615–1	5–5–65	54	7.9	.02	.00	98	22	4.5	2.0	288	44	16	.0	47	—	334	99	645	7.35
618–4	5–14–65	53	7.7	.00	.00	93	17	4.8	2.0	271	35	11	.0	39	—	300	80	[2]590	7.38
620–2	10–3–63	54.5	7.7	.48	.43	107	12	4.0	4.2	338	22	9.8	.0	28	360	316	47	[2]655	7.32
620–2	4–16–64	53	5.8	.02	.00	101	9.2	3.5	7.0	268	25	12	.0	58	379	290	70	612	7.26
622–7	4–12–63	56	10	.08	.04	88	13	39	2.5	227	24	70	.0	39	424	269	86	713	7.46
626–5	5–13–65	54	9.2	.00	.00	88	18	5.0	4.0	269	16	13	.0	50	332	292	73	565	7.35
627–6	6–20–63	56	8.5	.16	.00	80	16	8.4	1.0	256	7.4	14	.1	46	309	266	58	536	7.42
627–6	5–6–65	55	7.9	.01	.01	85	18	8.5	1.0	252	8	15	.0	56	323	284	80	549	7.44
628–3	4–4–63	54	8.5	.68	.03	84	11	2.9	1.5	236	21	9.3	.0	33	282	248	66	518	7.55
628–3	5–17–65	55	8.5	.09	.00	82	13	4.5	2.2	247	19	9.6	.0	34	288	256	56	485	7.51
8–619–1	10–21–63	56	15	.24	.08	101	23	6.5	2.5	354	56	8.0	.1	.2	399	348	59	[2]660	7.31
619–1	4–17–64	54	14	.32	.00	96	24	8.0	2.0	359	57	8.4	.0	.2	395	338	45	665	7.28
624–1	4–17–63	55.5	19	.23	.21	83	15	11	2.2	179	105	17	.0	3.8	391	269	126	566	7.20
626–1	4–16–63	54	8.5	.14	.00	83	33	22	6.0	306	21	34	.0	100	465	343	97	766	7.36
9–616–1	10–23–63	54	11	1.78	.07	75	29	4.5	1.0	276	54	13	.1	21	370	308	81	[2]680	7.51
616–1	4–23–64	53	10	.07	.00	74	31	6.0	2.0	273	55	19	.0	30	389	312	92	628	7.53
617–3	5–11–65	55	8.7	.02	.00	92	12	7.2	2.5	255	32	16	.0	36	335	280	70	[2]720	7.43
618–1	5–18–65	—	8.5	.08	.01	82	16	5.7	2.2	247	40	12	.1	36	325	272	68	537	7.48
618–6	10–23–63	53	8.7	.11	.05	83	13	6.0	1.5	251	16	13	.1	34	301	260	59	[2]515	7.43
618–6	5–11–65	54	8.2	.03	.00	86	12	9.9	1.9	245	23	22	.1	38	316	265	63	543	7.46
618–7	5–11–65	54	8.7	.00	.00	85	12	6.0	1.7	249	24	14	.0	34	310	260	60	523	7.48
620–2	5–11–65	55	10	.02	.02	122	12	9.3	14	320	29	28	.0	78	499	355	92	763	7.05
2–615–2	10–21–63	54	7.9	.83	.04	69	18	3.8	1.5	242	9	8.0	.1	37	270	244	49	[2]500	7.48
615–2	4–17–64	53.5	7.0	.02	.00	72	19	4.0	2.0	253	21	10	.0	38	303	258	50	523	7.46

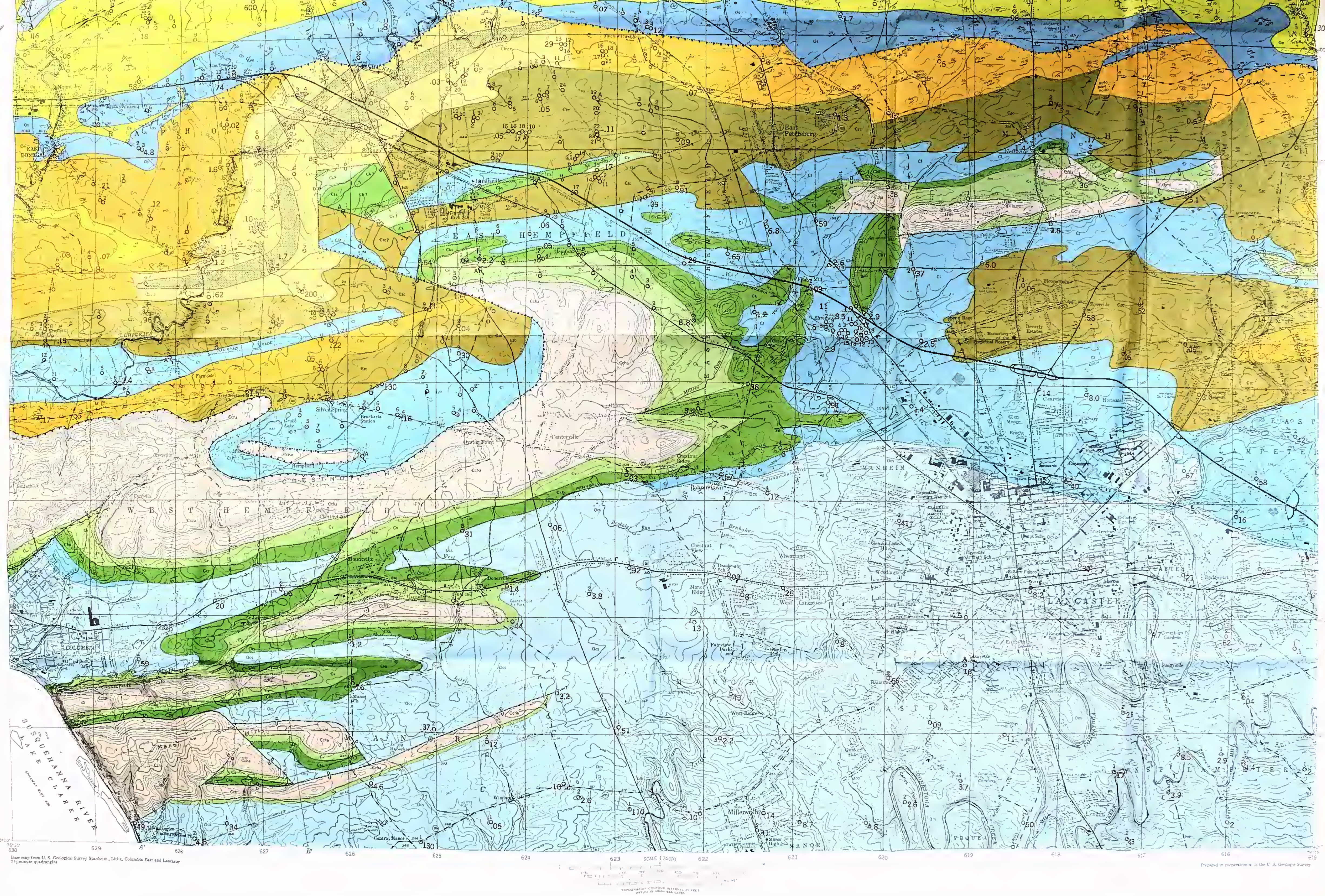
[1] Acidified sample
[2] Determined at collection site.



SUMMARY OF GROUND WATER POTENTIAL

Median specific capacity (gpm/ft. of draw down in 1 hour test)	Color Key	Public supply and industrial use	Small public supplies and some industrial uses	Domestic use
12	Os	Very Good	Excellent	Excellent
2.5	Cl	Fair	Excellent	Excellent
2.6	Ocs	Fair	Very Good	Excellent
1.0	Cks–Ck	Fair	Good	Excellent
0.44	Cv	Fair	Good	Excellent
0.5	Oe	Fair	Good	Very Good
0.2	Cbssc, Cbs, Csc	Poor	Fair	Very Good
0.14	Cm	Poor	Fair	Very Good
0.12	Czc	Poor	Fair	Very Good
0.14	Cr	Poor	Fair	Good
	Omy, Oa, Oo	Unknown potential—units of minor areal extent		
	Trdb, Oco, Ccha	Not studied		

Decreasing potential



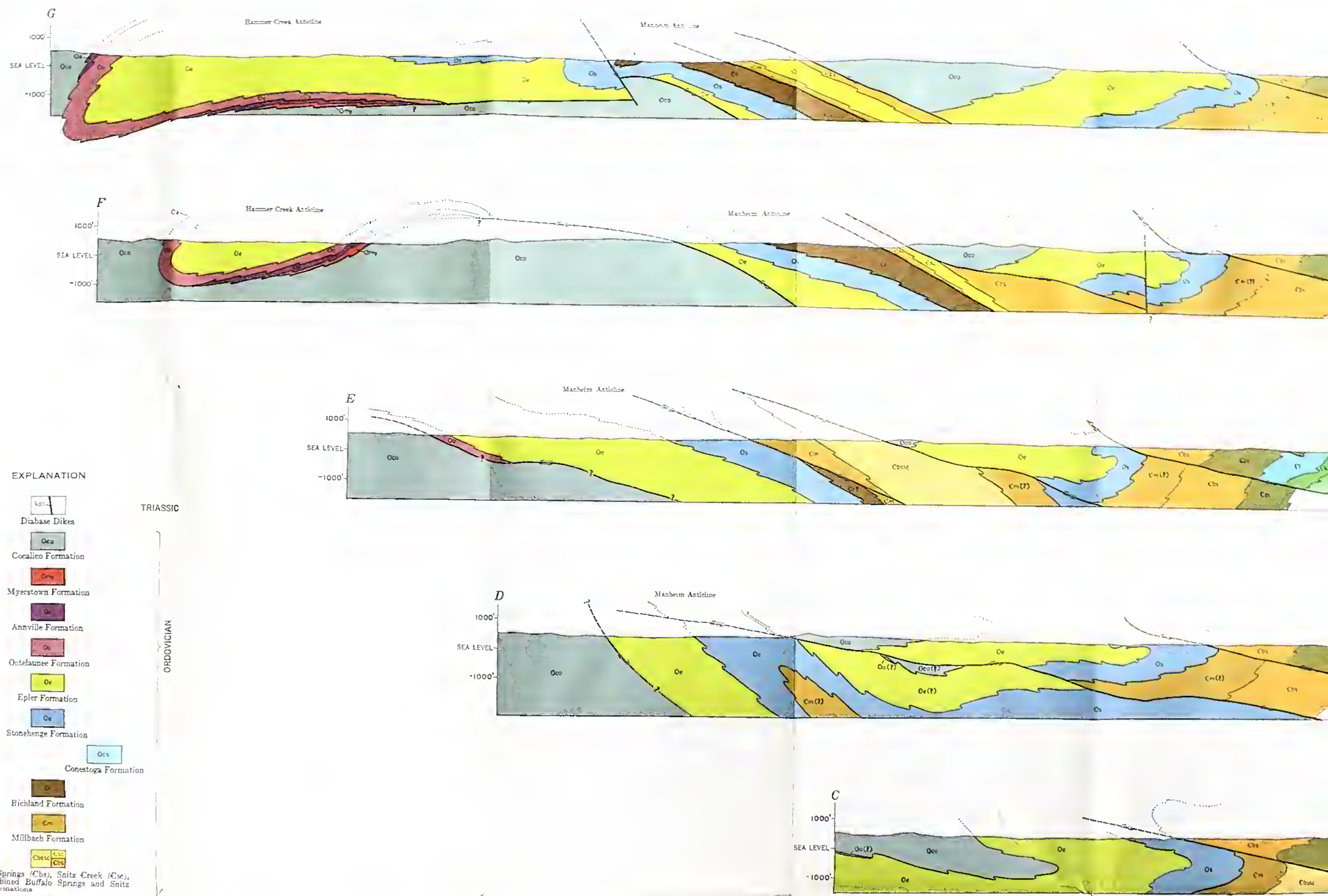
GEOLOGIC AND HYDROLOGIC MAP OF THE LANCASTER 15-MINUTE QUADRANGLE, PENNSYLVANIA

BY

HAROLD MEISLER AND ALBERT E. BECHER

1970

TOPOGRAPHIC AND GEOLOGIC SURVEY
Arthur A. Socolow, Director



EXPLANATION

TRIASSIC

Diabase Dikes

ORDOVICIAN

Oco — Cocalico Formation

Omy — Myerstown Formation

Oa — Annville Formation

BEEKMANTOWN GROUP

Oo — Ontelaunee Formation

Oe — Epler Formation

Os — Stonehenge Formation

Ocs — Conestoga Formation

CONOCOCHEAGUE GROUP

Cr — Richland Formation

Cm — Millbach Formation

Cbssc, Csc, Cbs — Buffalo Springs (Cbs), Snitz Creek (Csc), and combined Buffalo Springs and Snitz Creek Formations

CAMBRIAN

Czc — Zooks Corner Formation

Cl — Ledger Formation

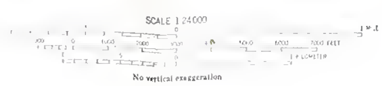
Ck — Kinzers Formation

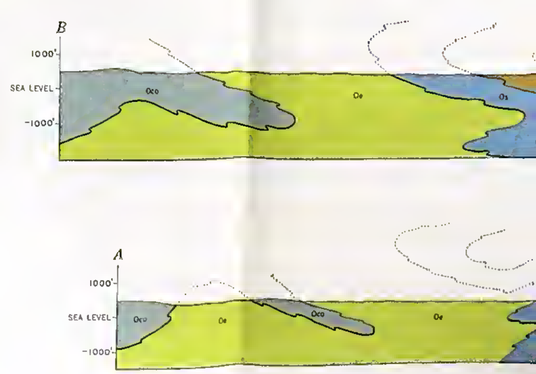
Cv — Vintage Formation

Cchs — Chickies, Harpers and Antietam Formations

Contact, dashed above land surface

Fault, dashed above land surface
Arrows indicate relative movement





GEOLOGIC SECTIONS
SHOWING STRATIGRAPHY AND STRUCTURE
OF THE
LANCASTER 15-MINUTE QUADRANGLE

BY

HAROLD MEISLER AND ALBERT E. BECHER

1970

COMMONWEALTH OF PENNSYLVANIA
STATE PLANNING BOARD
Irving Hand, Executive Director